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FOR ENGINEERS AND CONTRACTORS CONTROLLING THE DESIGN, SPECIFICATION, INSTALLATION AND MAINTENANCE OF HEATING, VENTILATING AND AIR CONDITIONING.

HEATING & VENTILATING

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PROFITS IN AIR

INDUSTRY is showing a steadily increasing appreciation of the profit possibilities available to it by making a fuller use of air in its daily life.

This is evident not only in new factory construction but also where changes in processing or in equipment are made in existing plants. It is evident, too, in the steady increase in the variety of industry process work where air conditioning is not only paying profits but where its use is absolutely indispensable. So also is industry now showing a growing awareness of its responsibility in furnishing its employes with a working atmosphere, at least free of those conditions capable of resulting in occupational diseases. Just around the corner can be seen the urge to further raise standards of air quality in the working space in order to meet employe demands and to promote profit through better employe and public relations.

The new factories now under construction and those recently completed, naturally show most strikingly the effects of this attitude toward the better use of air. To such an extent is this the case that the new factories contain examples of a practice in heating and ventilation which goes way beyond what was considered suitable only ten years ago.

We are now in the midst of a period of great industrial activity and one in which new factories are appearing at a rate unequalled for years past. All of this creates a most favorable opportunity for all of us. Consequently, we believe that it is extremely timely to start our new series of articles on "Profits In Air" with this issue. The aim is to show by examples how recent factory building is making use of our equipment to advantage. As the series progresses it will be seen what the industrial leaders are doing. We believe that others will rapidly fall into line and that air will steadily come to occupy its rightful place in the whole industrial picture.

C. H. B. Hotchkiss

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VOLUME 36 NUMBER 11

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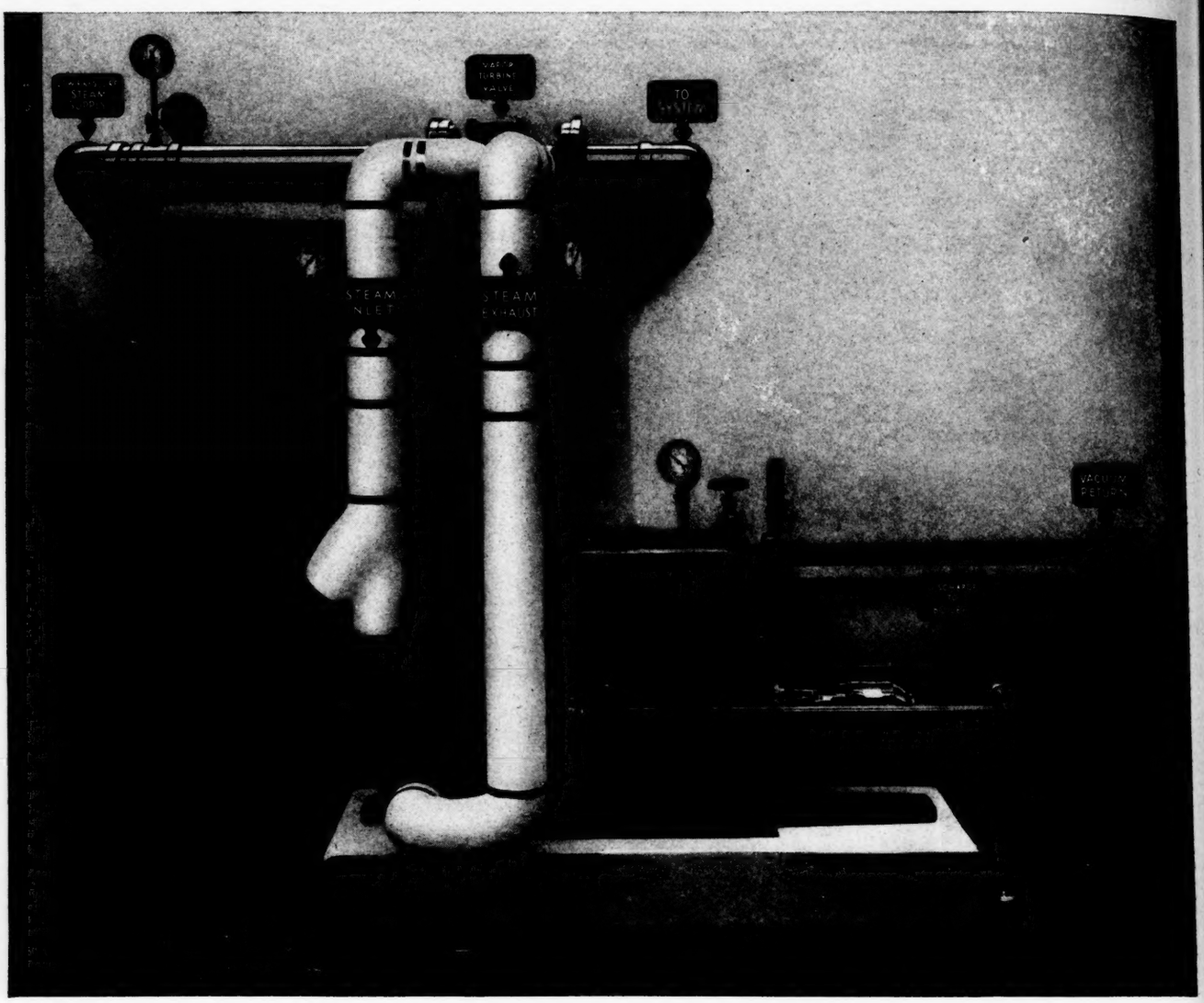
Where Heat Must Not Fail— Install this SAFE Heating Pump!



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is independent of electric current failure, and continues to operate as long as there is steam in the system.

This is because the prime motive power of this economical pump is a special steam turbine, controlled by a unique "Vapor Turbine Valve", which automatically bypasses from the heating main a small portion of steam, the exact amount necessary to develop the power needed to remove the condensate and maintain the required vacuum on the system. Even this small amount is passed immediately back to the mains, and goes on to the system with little heat loss. This pump operates on any system, high or low pressure.

The Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump. Bulletin on request.

THE NASH ENGINEERING COMPANY

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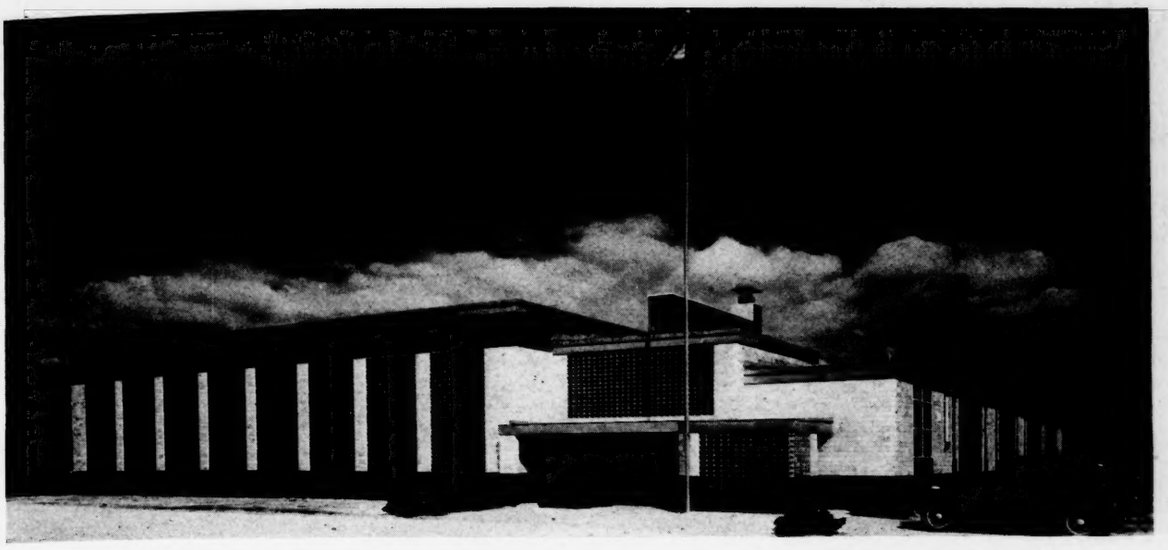


Coolspring Township School, Michigan City, Indiana. Photo courtesy of Crane Company.

Forced Hot Water Heating System for Modern Rural School

AMERICAN tradition testifies to the hardships experienced by the country school child of former generations, but present-day rural students will have to look elsewhere for story material with which to impress their grandchildren. At least those located in the vicinity of the Coolspring Township School near Michigan City, Indiana, will, for the old school structure here has been replaced by a modern building of glass and glazed brick construction.

Coolspring Township School is of modern design with few windows, much of the wall area being glass brick. Several deviations from ordinary heating and ventilating practice were effected and after one season of operation have shown that they were well justified. In the first place, soil conditions were such that the excavation and finishing costs for a basement would have been excessive. A separate building for the heating plant was impractical and no space was available on the first floor for the location of the boiler plant. As this is only a two story building, it was decided to locate the boilers and general supply fan on the top floor where there was sufficient space. The fuel oil for the burners is pumped from two underground tanks.

Another variance from usual practice is the size and number of boilers used. The design conditions for the system were an inside temperature of 70F with an outside temperature of —10F. The calculated load for the entire system—including tempering coils, unit heaters, unit ventilators and domestic hot water heaters—was 6,218 sq. ft. equivalent direct steam radiator surface. Ordinarily one or two boilers would be used, but in this installation five boilers were used on three separate circuits. These boilers are connected in a series so that only those burners required to keep the water temperature at 180F are in operation. The result has been that only 11,000 gallons of fuel oil were used during the 1938-39 heating season in a locality which has about 6,300 degree-days.

Two of the boilers have built-in tank hot water heaters with a capacity of 135 gallons and a temperature rise of 100F (from 50F to 150F) based on 180F boiler water. A forced circulation hot water system with reversed returns is used with the circulators controlled by immersion type aquastats, located in the suction piping to the pump and set so that the pumps will start when the temperature in the return mains drops below 150F.

Air for the classrooms is provided by an overhead indirect system in which outside air passes over tempering coils which raise the air from —10F to 80F when passing 9,600 c.f.m. The air then passes through two main trunk lines (see Fig. 1) to individual risers down to each room. A reheating element, located directly behind the discharge grille, is installed in the plenum chamber to each classroom. This serves as a source of auxiliary heat supply and temperature control. The classroom reheaters and the tempering coils in the fan plenum chamber are all on the same circuit and actuated by the same system of controls.

The Assembly Room and Gymnasium is heated and ventilated by two ceiling type unit ventilators which are on a separate circuit. Both ventilators are at one end of the gym floor, as can be seen in Fig. 2; the stage is located at the left and chairs can be set on the basketball floor so that the room serves the dual function of assembly room and gymnasium. The control dampers are located in the masonry flues and are linked together and controlled by a single damper motor from a switch located in the storeroom. In case of a current failure the flue dampers will close.

Unit heaters are installed in the principal's office, kitchen, boys' toilet, girls' toilet, rotunda and voca-

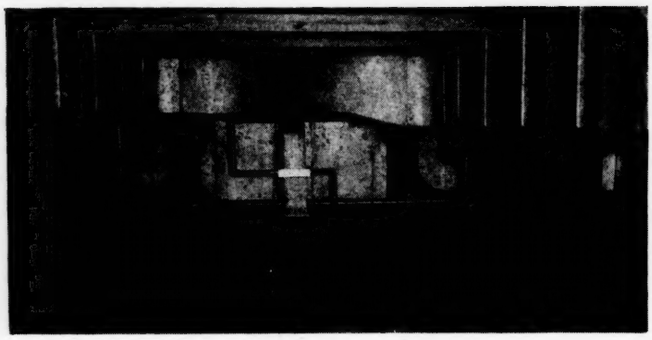


Fig. 1. The two main trunk lines from the fan plenum chamber are shown here.

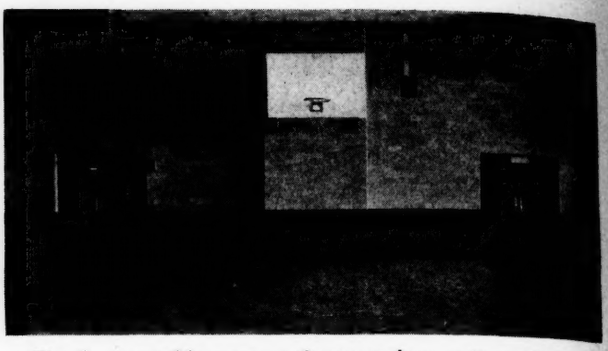


Fig. 2. Assembly room and gymnasium unit ventilators in the Coolspring Township School.

tional classroom. In the case of the kitchen, rotunda and principal's office, these heaters are provided with recirculating boxes of the type shown in Fig. 3. Where recirculating boxes are not used with unit heaters, a separate exhaust system is provided to assure proper ventilation.

Separate heating and ventilating was provided for the cloak closets. The entrances to these cloak rooms are shown at the right and left of the classroom door, Fig. 4, and a view of one of the rooms appears in Fig. 5. Ordinarily in such a small installation there would be no separate ventilation for these spaces, but in this case a branch was taken off the supply and exhaust ducts to furnish a separate supply and exhaust for each cloak closet. As children are prone to seek the deepest snowdrifts and puddles of water on their way to and from school, and arrive at school in a thoroughly soaked condition, this is a good precaution from both the health and comfort standpoint. Walls of these rooms are glazed brick to prevent moisture absorption.

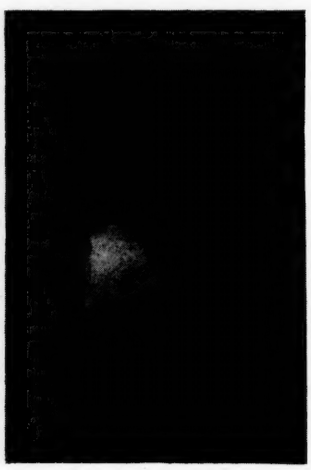
Separate exhaust fans are provided for the boys' and girls' toilets, each located in the room which they serve. Each toilet has an exhaust grille and the air passes from these through the fan and out a roof discharge. A single exhaust fan with a capacity of 6,000 c.f.m. working against a static pressure of ½ in. at 260 r.p.m. handles the exhaust air from the classroom. An assembly exhaust with a capacity of 4,000 c.f.m. at .4 in. static pressure and 300 r.p.m. comprises the rest of the exhaust system, with the exception of several disc fans which are used to exhaust fumes.

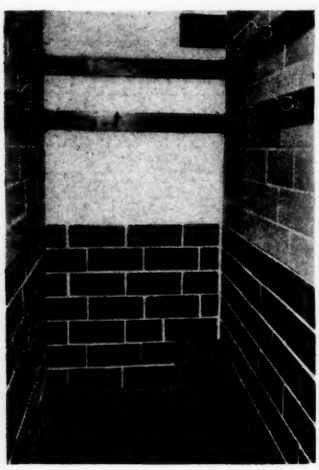
Bypass and face dampers for the classroom supply fan are controlled by a 60 to 80F range thermostat located in the fresh air room. Motors on these dampers are gradual acting and reversing. Outside air dampers for the same coils operate in conjunction with the damper in the exhaust flue and the recirculating damper. Damper motors are connected so that in case of current failure all dampers will close against outside air. This is to prevent freezing the water in the tempering coils.

As an additional protection an immersion thermostat in each line, close to the tempering unit, closes the outside air dampers if the circulating water temperature falls below 70F, regardless of the action of the other controls. Also, a gradual acting damper installed back of the outside air intake louvers will automatically close the outside air supply when the temperature at this point drops below 35F.

For warm weather ventilation the system is reversed; the warm air damper in the exhaust duct and fan discharge duct are closed. The stack damper remains open and, with the fan operating, air is drawn from outside the classrooms, through the reheating grilles, and discharged. Dampers for the control of this cycle are manual.

The cost of complete summer air conditioning in this





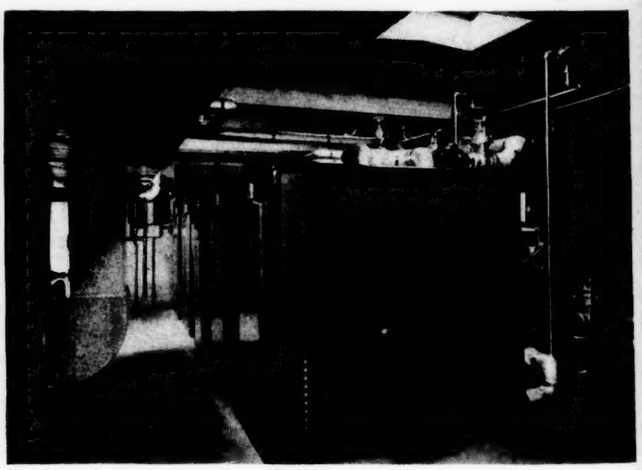
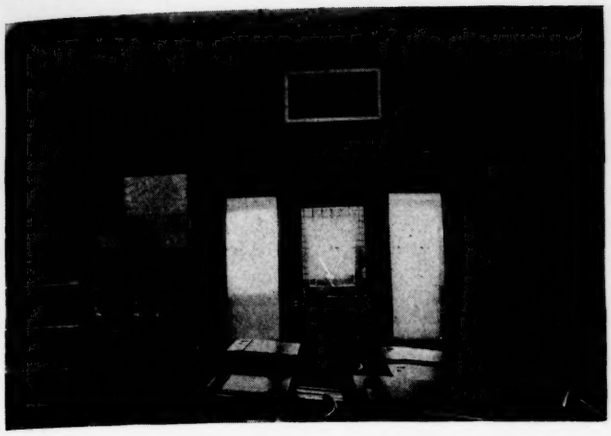


Fig. 3. (Left). Unit heater and recirculating box in the kitchen. Elsewhere the unit heater was flush with the wall and the recirculating box was on the other side of the wall. Fig. 4. (Center). Interior of one of the cloak rooms, with supply grille at the top and exhaust air discharge at floor level. Fig. 5. (Right). Gas fired boiler plant in the Coolspring Township School. Photo courtesy of Crane Company.



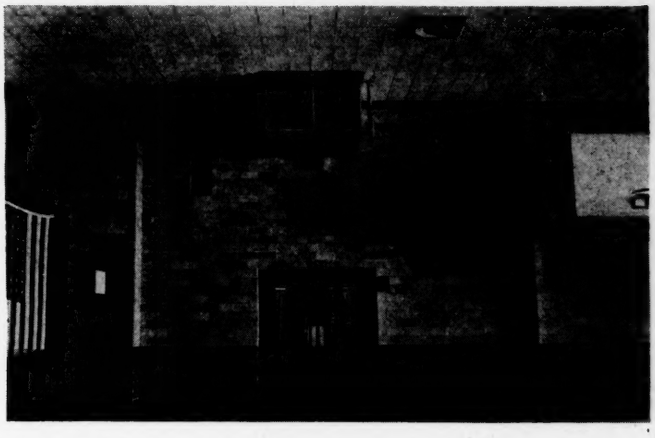


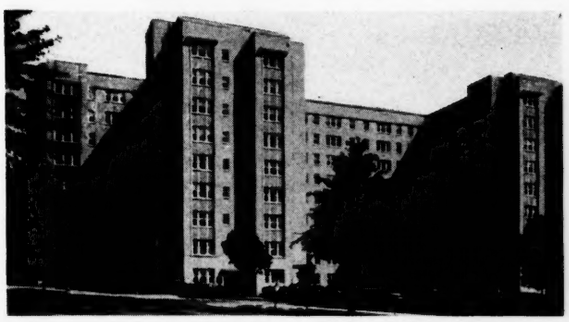
Fig. 6. (Left). Classroom looking toward door. Cloak room entrances adjacent to door. Above the door is one of the supply outlets. Reheater coil is located directly behind the grille. Exhaust grilles are located on the opposite wall at the floor line. Fig. 7. (Right). Ceiling type unit ventilators in the assembly room and gymnasium.

building is hardly justified at the present time as this is a rural school and closes early in the spring and opens late in the fall. Also it is located far enough north so that there is little demand for cooling during the period of school occupancy. However, should it ever become desirable to cool any part of the building for summer occupancy—such as the assembly room for public meetings—this could be done economically because of the system of zone control. As the system is laid out now, it is possible to cool all or part of the building without any major construction changes. Thus, this school is adequate for the present and prepared for the future.

The school was designed by John Lloyd Wright, architect, of Long Beach, Indiana. The heating and ventilating system was designed by E. A. Simpson and installed by Simpson and Adamson of Michigan City, Indiana.

Roof Sprays Eliminate Cracked Plaster

ROOF cooling has during the past few years found an extensive application for reducing the load on the refrigeration equipment in air conditioned buildings. A recent installation, however, points out some other advantages in reducing roof expansion and cracked plaster.



This installation was made on the roof of a newly constructed, million-dollar, air conditioned apartment building at 4801 Connecticut Ave., Washington, D. C. The roof of this building is of the concrete slab type with a suspended top floor ceiling. An air space of from two to three feet is provided between the ceiling and the roof and 4 in. of insulation is placed immediately above the ceiling. The roof area is approximately 23,000 sq. ft. made up partially of slag roofing surface and partially of tiled surface for a roof garden.

While the building was being decorated hot weather struck the city and soon afterwards the plaster began to crack in the top floor apartments, especially alongside columns which were hidden in the walls. The builder noticed that each morning the cracks were narrower than after the heat of the day in the evening. It was believed that the insulation was intensifying the heat under the roof and this caused the concrete roof to expand excessively.

In line with this thought it was decided to install an automatic roof spraying system to prevent overheating of the air space.

Because of the different roof surface, two separate systems were installed. Each system consists of a copper water supply pipe, automatic water control, copper distribution piping and spray nozzles. The automatic water control is operated by the roof temperature and turns on the water when the roof temperature reaches a predetermined point. As soon as the roof temperature falls the water is shut off.

Soon after the system was placed in operation it was noted that the air space temperature was considerably lower than before and excessive expansion was stopped. The builder was able to repair the cracks in the plaster and no new ones have opened up. A recording thermometer installed in the two-foot air space for 11 days disclosed that the temperature ran between 75F and 84F. Before the installation 150F was often noted.

The roof cooling installation was designed and installed by the April Showers Co., Washington, D. C.

When The Contractor Promises Satisfaction

By CHARLES R. ROSENBERG, Jr.†

THERE'S a trick in promising a customer *satisfaction* on a heating or ventilating job. It's not done with mirrors but with words and laws. It's one of those legal tricks that may cause heavy loss.

Suppose, for example, that a contractor undertakes to complete a job to the customer's "complete satisfaction." May the customer refuse to pay for the job because it is "unsatisfactory"—according to him—and get away with it?

When a contractor undertakes a job on the condition that the customer is to be "absolutely satisfied," he is running the risk not only of his ability to produce such a job, but also of the customer's honesty when the time comes to pay for and accept the work. A contractor who accepts a job under an arrangement whereby it is left to the customer to decide for himself whether or not he is satisfied, will be left without payment and without redress should the customer refuse the job.

Sometimes the courts say that in such cases the customer cannot refuse to pay for the job unless the refusal is made in good faith. This is not likely to be helpful to the contractor left with an unpaid job on his hands by a "dissatisfied customer," for it would be extremely difficult, ordinarily, to show that the customer's dissatisfaction is not asserted in good faith. The contractor may be satisfied in his own mind that the dissatisfaction is put forward as an excuse to avoid payment, but proving it is another matter.

Therefore, Rule One in promising a customer satisfaction is *Never guarantee "satisfaction" in language that makes the customer the sole judge of whether or not he is "satisfied."*

It is entirely practical and safe for a contractor to guarantee satisfaction, however, provided the guarantee or promise is so worded that satisfaction is not to be determined at the whim of the customer but by standards that would satisfy any reasonable person. In other words, a contractor who promises to do a "satisfactory job" means a job done as well as it is possible to do it under all the circumstances.

Thus, "satisfaction guaranteed" printed on a bill or letterhead means satisfaction to any reasonable person. A promise to produce a "satisfactory job" would ordinarily be interpreted by the courts in the same way.

When a customer gives a contractor a job under a promise of "satisfaction guaranteed," not only does the law interpret this guarantee to mean "reasonable satisfaction," but it is assumed that the customer will be reasonable in passing on the finished job.

Heating and air conditioning contractors who have been victimized by allegedly "dissatisfied" customers have learned that assertions of dissatisfaction are used by a certain type of customer to cut down the price of the job. The customer, while claiming to be grievously dissatisfied, is nevertheless willing to take the job if given a substantial price reduction. In such a case, if the contractor did not undertake to do the job to the absolute satisfaction of the customer but promised only to do a satisfactory job, he should not permit the customer to obtain a price reduction on a claim of dissatisfaction, for which there is no reasonable ground. The law will back the contractor who has produced a job that should be satisfactory to any reasonable person, and will not permit a customer to avoid payment on a flimsy statement of dissatisfaction.

In some instances the courts have permitted customers to reject jobs as "unsatisfactory" where the matter involved personal taste or individual preferences. For example, where personal "satisfaction" is guaranteed on a job where the radiators are to be in harmony with a house decorative scheme and the customer is genuinely dissatisfied with the result because the radiators are artistically inharmonious with the general decorative plan, the law might permit the customer to reject the job and refuse payment. Hence the contractor should be wary of promising satisfaction on jobs where he cannot be certain of the result and when, for reasons of individual taste, it cannot be shown that the job should be satisfactory to any reasonable person.

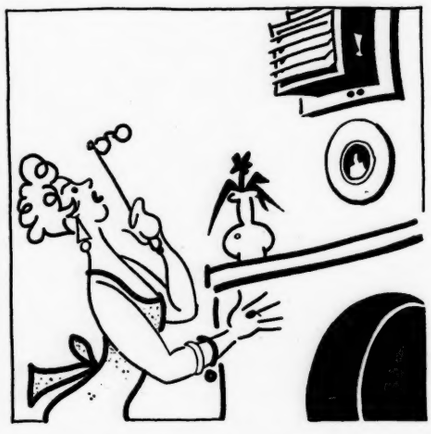
Just how a customer may escape paying for a job where personal taste and individual preferences are involved was illustrated in a case where a prominent actress agreed to pay an artist a large sum to paint a picture that would be "satisfactory" to her. The artist painted the picture, but his customer refused to pay on the ground that it did not satisfy her. A number of art experts stated that the picture was an admirable piece of work. Nevertheless, the court ruled against the artist; the "dissatisfied" customer was not required to pay.

A contractor can safely deal with this question of "satisfaction" by following these few rules:

Never promise a customer satisfaction in language indicating that the customer shall be the sole judge of whether he is satisfied or not.

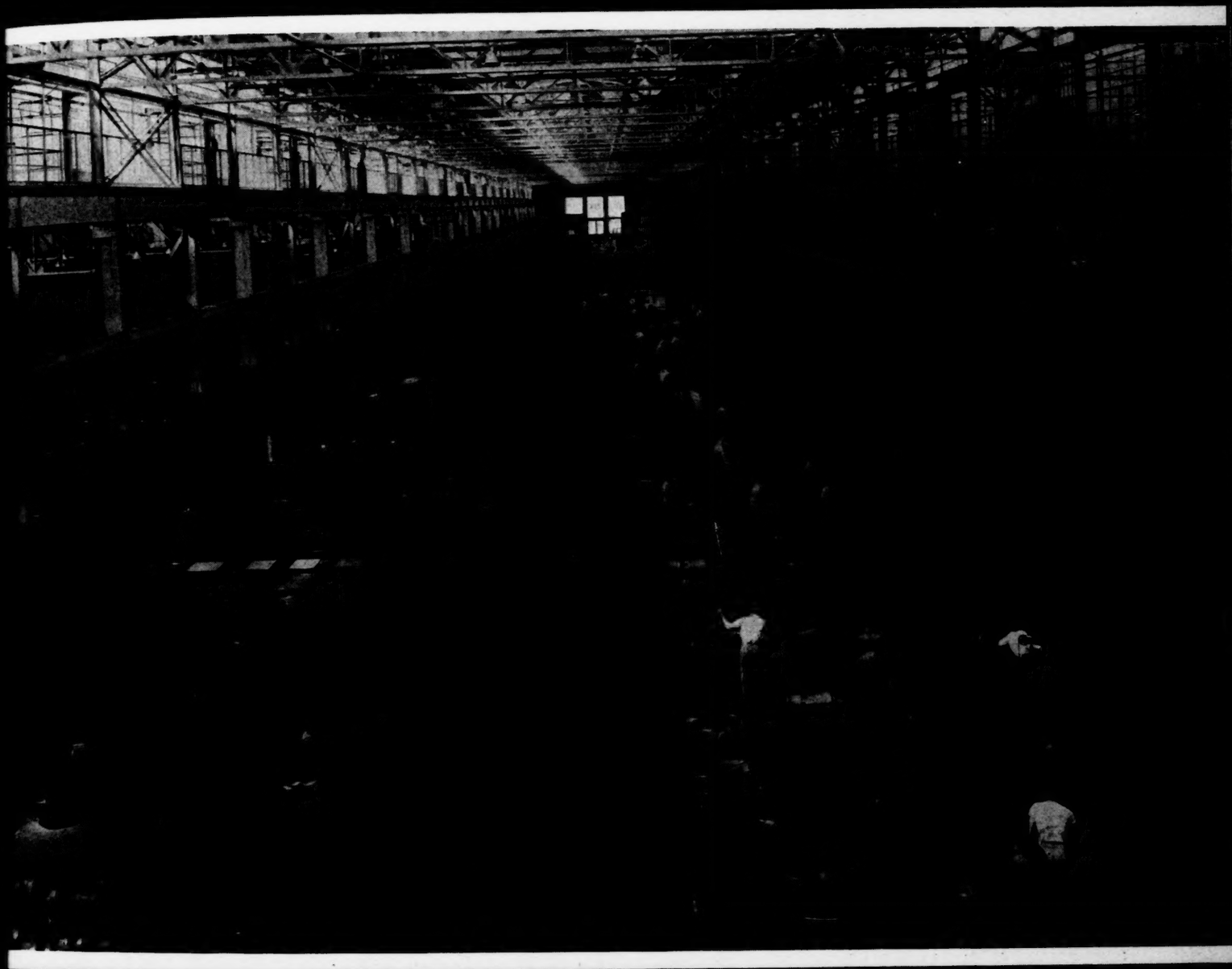
Never promise "satisfaction" when the result of the job is uncertain at best or where the customer's personal tastes or preferences are concerned.

"Satisfaction" may be safely promised or guaranteed only under circumstances and in language where it is clear that the guarantee is only of satisfaction to any reasonable person.



Be wary of promising satisfaction where personal taste is involved!

†Attorney-at-Law, Media, Pa.



Ford Motor Company

conditions its Tool and Die Shop with a cube of 15½ million cubic feet. A split system with hot water as the heating medium is employed. Provisions are made for future cooling. Feature of the system is the air cleaning for eliminating dust from precision metal working operations.

BY CLIFFORD STROCK

EVEN in these days of huge air conditioning systems it is startling to find a building nearly a quarter of a mile long air conditioned. It is not so startling to find that this building is one of the Ford Motor Company buildings, since engineers and the general public, too, are accustomed to accomplishments done in a big way by the Ford Company.

Every one likes to work in the shade of the old apple tree where he is surrounded by a continuous air motion which keeps him cool without refrigeration.

With this idea in mind and in consideration of the vastness of the area (300 ft. x 1225 ft.), it was considered a worthwhile experiment by the Ford engineers to simulate the conditions under the old apple tree; namely, a continuous stream of slowly moving air, while avoiding drafts and yet with enough velocity to absorb perspiration and carry away heat.

This summer's operations with the system only partially complete indicated satisfactory conditions can be produced without refrigeration or at least less than the usual requirements.

This air conditioning installation is in the Tool and Die Shop in the Ford Rouge Plant at Dearborn, Mich. The building is a single-story structure, and contains approximately 15½ million cu. ft. of heated space.

The working area consists of the entire first floor while lunch rooms, coat rooms, wash rooms and shower rooms are concentrated on a 20-ft. mezzanine running the length of the building on both sides. The function of the department accommodated in this building is the making of tools and dies which are used in the production of Ford cars.

The shop concentrates almost all of the Rouge Plant tool and die work under one roof. The structure probably is the largest building in the world designed solely for tool and die work. There are about 1400 machines in the shop, over 500 of them new. At the present time there are 2800 men working there.

There are three main divisions in the shop. One, body die and small die construction; two, tool, jig, fixture and gauge division; and three, machine construction and repair division. In the last, new machines and special equipment are built and general overhauls made on plant machinery.

The spacious, uncluttered arrangement of the building and its excellent daytime lighting are conspicuous features. The high central bay runs entirely through the building with two lower bays on either side. There are monitors at right angles to the center monitors to admit maximum daylight to the interior. Monitors, sidewalls, and walls are largely of glass and columns are held at a minimum.

Reasons for Air Conditioning

Tool and die making is precision work and the men who do this are highly skilled workmen and technicians. To provide these men with the optimum in working

conditions the heating system was combined with a ventilating system to produce comfort air conditions throughout the entire building. The system is now complete for winter air conditioning and requires only the addition of refrigeration to give absolute control of temperatures for summer conditions, all other provisions such as piping, controls, coils, eliminators, etc., for cooling having already been incorporated in the design and installation. Even now mill water may be circulated through the system and thus effect a partial cooling for the summer. It is estimated that approximately 3500 tons of refrigeration will be required to produce comfort conditions when the outside air conditions are 95° D.B. and 76° W.B.

In addition to this it is necessary to maintain the entire Tool and Die Shop as dust free as it is possible since accurate and precision machinery is used in the production of the tools and dies. Dust would seriously affect the operation of such machines and would normally require special effort on the part of the men to keep their machines clean. With the air conditioning system in use the doors and windows of the shop can be kept closed and thus reduce the infiltration of outside dust. Outside dust was likewise minimized by extensive sodding and landscaping in the vicinity. Industrial dust was minimized by a very complete system of industrial exhaust and dust collection.

General Description of the System

As has been indicated the system is of the *split* type using forced hot water as the heating medium. Radiation was installed on the outside walls and unit heaters were located at the entrances. Heating coils were used in the air conditioners to warm the air supply to the building.

A loop system of main supply and return hot water heating lines was installed in a system of tunnels be-

THIS INSTALLATION

Owner—
Ford Motor Company

Location—
Rouge Plant, Dearborn, Mich.

Architects and Engineers—
Giffels & Vallet, Inc., Detroit, under the direction of H. B. Hanson, Power & Construction Dept., Ford Motor Co.

Equipment Installed by—
The Donald Miller Co., Detroit, Mich.

The view on the frontispiece to this section is of the interior of the Ford Tool and Die shop located at the Rouge plant. The shop contains 15½ million cubic feet of heated space.

NUMBER 1

Fig. 1. A partial view of the Ford Tool and Die shop which is 300 ft. wide and 1225 ft. long. Note the unusual type monitor roof.

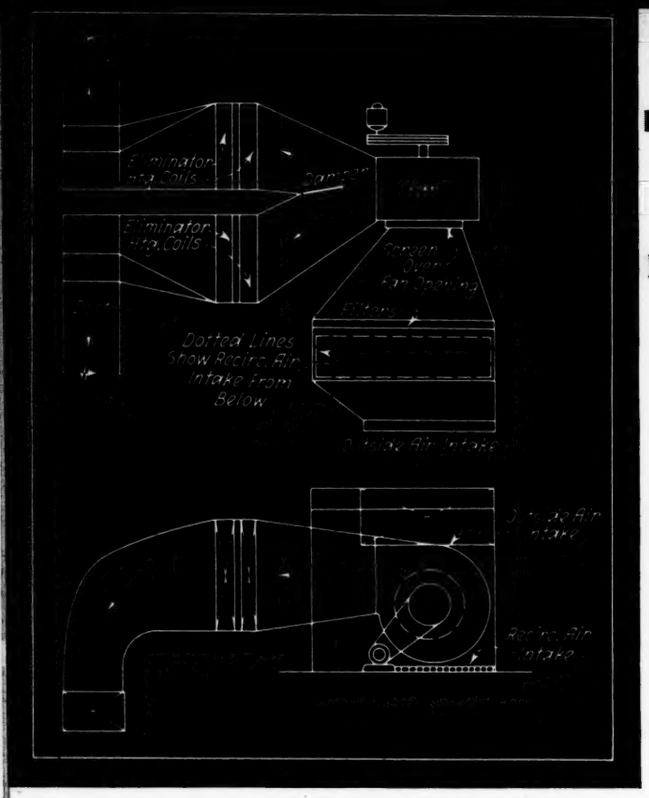


Fig. 2. Sketch of plan and elevation of typical air conditioning unit. These units are located in the roof trusses and heat, circulate, and clean the air in the winter, and clean and circulate it in the summer. Provision is made for future cooling.

Fig. 3. The drawing below, covering both pages, shows a plan view of the Tool and Die shop and indicates the location of the heating and ventilating units, connecting ductwork and direction of air distribution. At the top is a section of the plan showing the balcony. Two balconies are provided, one on each side, although only one is shown. The unit heaters are placed opposite the doors or, where there is a balcony above the doors, they are located under the balcony rather than on the balcony as shown.

low the first floor and valved branches from these mains were extended to branch mains serving the radiation, unit heaters and air conditioners.

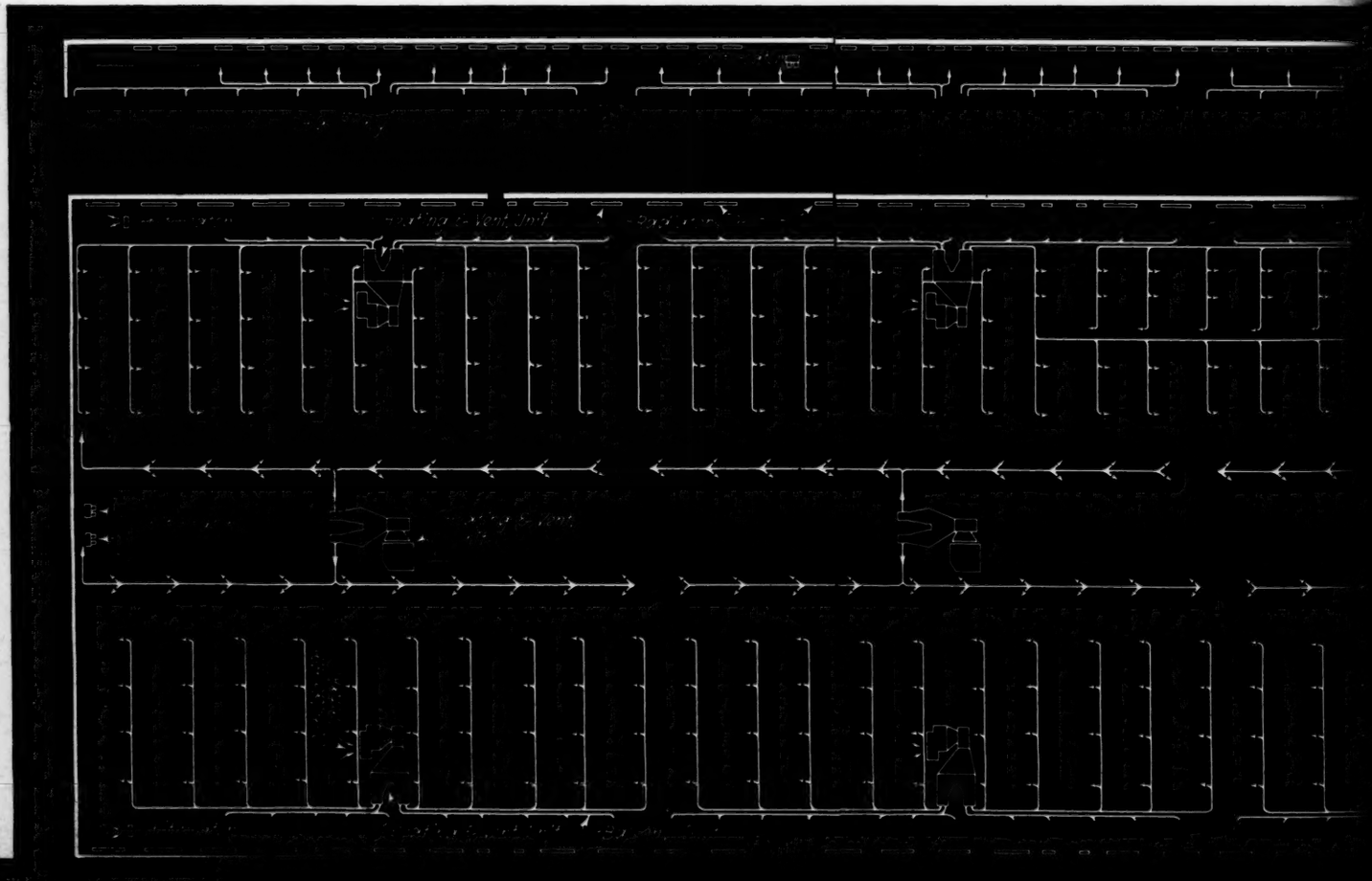
Instantaneous heaters for heating the hot water and the pumps for circulating it were installed in a heater room adjoining the main tunnel. A flash tank and condensation pumps were also installed in the heater room. Expansion tanks were suspended from roof purlins in the high monitor.

The air conditioners are arranged for a blow through type of system and consist of blowers, water type heating and cooling coils, eliminator plates, drain pans, filters, fresh air and recirculating inlets all in connection with a system of supply ducts and grilles located in truss spaces.

Pneumatic automatic temperature control has been provided, including fresh air and recirculating dampers, zone control valves for radiation, unit heaters and air conditioner coils, duct thermostats, and room thermostats, all to give close regulation of the temperatures in all parts of the building. The temperature leaving the instantaneous water heaters is controlled by hot water temperature regulators and thermostatic adjusting elements which are in turn governed by a master thermostat placed outside of the building to vary the leaving temperature to suit outside conditions.

Heater Room

The heater room is located below the ground floor in the center of the building longitudinally and to one



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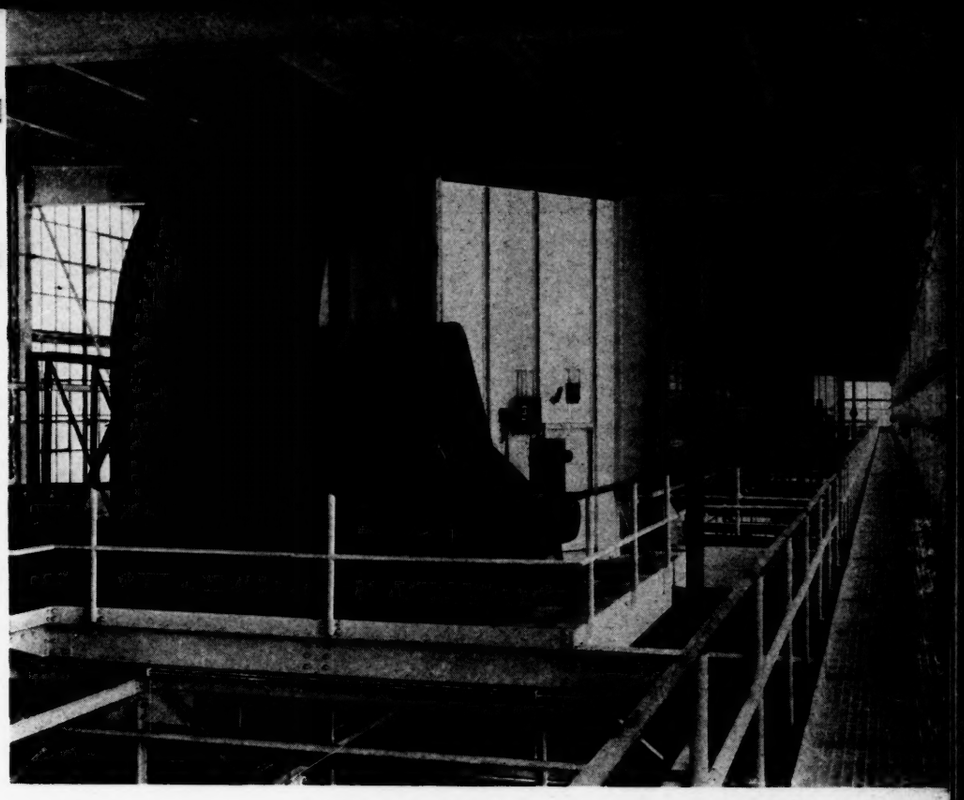


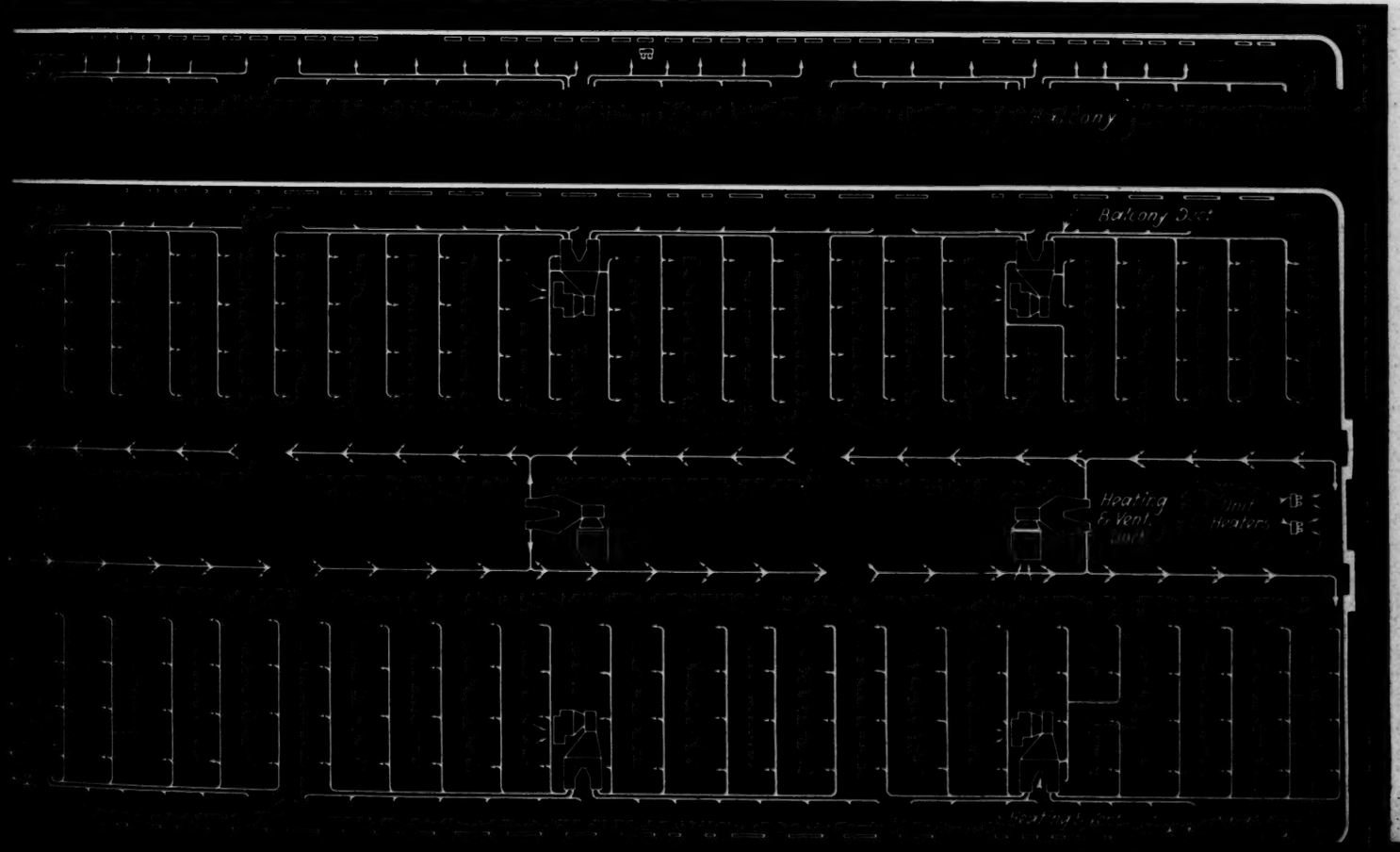
Fig. 4. One of the heating and ventilating units with hot water supply riser, fan, and motor in the foreground. Another unit is seen in the extreme background. Cleaning, circulating, and heating are provided by these units in the winter, cleaning and circulating in the summer.

side transversely. High-pressure steam is supplied to this heater room from a high-pressure steam main with pressures ranging from 140 to 175 lb. per sq. in., and corresponding temperatures from 360F to 600F. The steam is fed to two instantaneous water heaters where the water is heated from 175 to 200F.

These heaters are of the two-pass shell and tube type, each heater being capable of raising 3300 gal. of water per min. through the 25F temperature range indicated above. Two hot water circulating pumps force the water thus heated through the distribution system of heating mains and branches. A third pump was also installed as an alternate. Each pump has a capacity of 3300 g.p.m. working against a total head of 125 ft.

The high-pressure steam in passing through the instantaneous heaters is condensed, but still under pressure, so that it is drained to a flash tank where it flashes into low-pressure steam. This low-pressure steam is then used in a third heater which is the same in capacity and design as the two previously mentioned heaters. Thus all of the energy remaining in the high-pressure condensation is conserved. The water heated by the low-pressure heater is mixed with the water from the other heaters and thence circulated through the system of piping.

The condensation from the flash tank drains into a



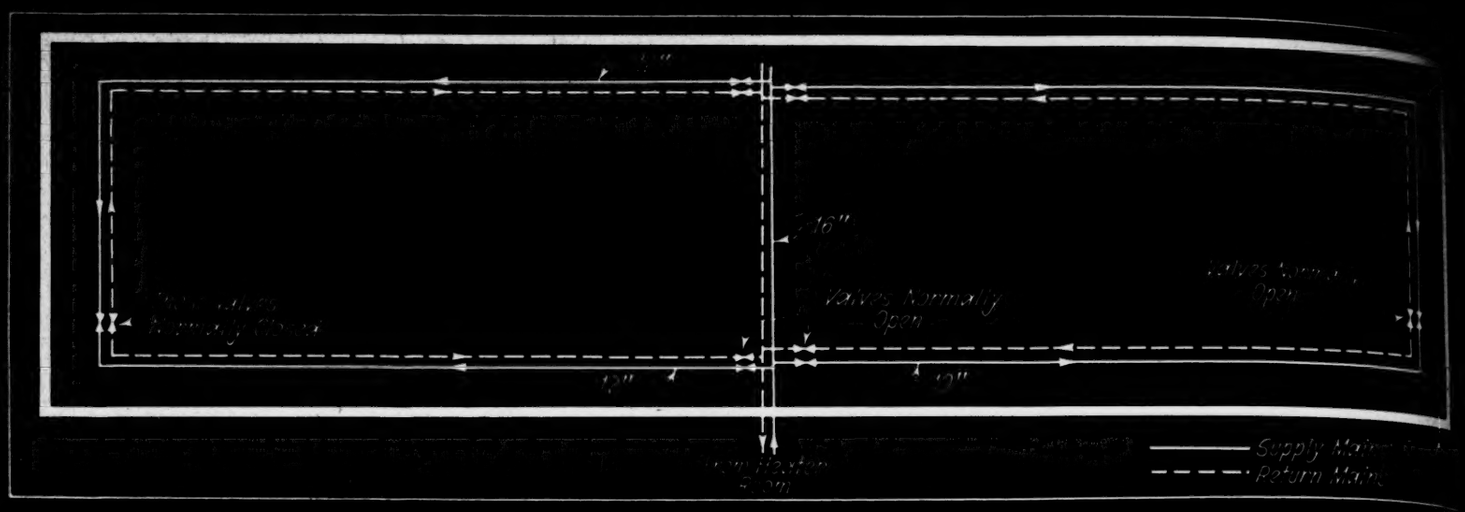


Fig. 5. Plan view, not to scale, showing supply and return main arrangement in tunnels below floor. Shut-off valves are provided so that, in case of repairs, hot water can be pumped in the opposite direction to the arrows.

condensate receiver and is pumped back to a main return line leading to the power house by means of two condensation pumps. The condensation from the low-pressure heater is drained to a separate condensation pump and receiver unit and thence discharged into the main return line.

Adjacent to the heater room on the ground floor a space has been provided for two future refrigerating compressors which will cool water through a direct expansion water cooler. This chilled water will be cross-connected with the hot water circulating system so as to provide chilled water to the air conditioning units throughout the building.

Distribution System

The hot water leaves the heater room in one large main through a system of tunnels which entirely encompasses the building underground. At the opposite side of the building, the piping branches both ways, encircling the building and returning. (See Fig. 5.) Shut-off valves are located so that in case of trouble or repairs hot water can be pumped in the opposite direction to the arrows. The piping is also looped in elevation as well as in plan, as in Fig. 6. Risers come up from the tunnels on each side of the building and cross it transversely at each section along which the air conditioning units are located. This method of looping the piping is a ring type header system which Ford Motor Company employs.

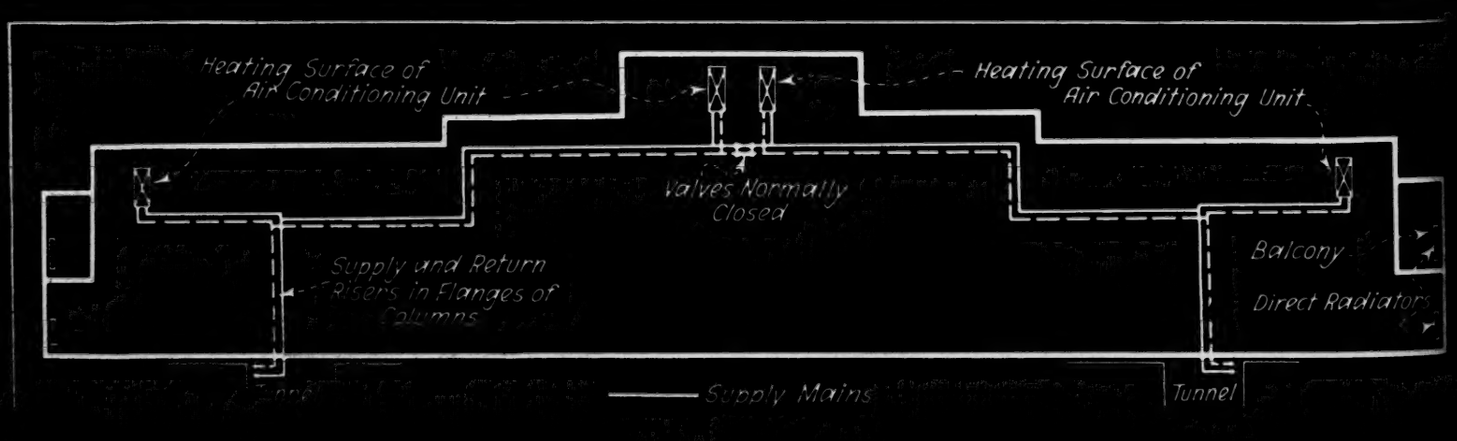
The piping throughout the entire system was electrically arc welded except at the various pieces of equipment where flanges were required. Black, extra strong, seamless steel tubing is used for high-pressure steam, while Grade B seamless steel tubing is used for low-pressure steam and hot water.

One of the features of the installation is the fact that all of the main piping is run underground in tunnels. These tunnels, in addition to carrying the steam and hot water lines as required, also provide a convenient and easily accessible space for the distribution of all the mains for all the services required in this building.

An all-welded slip type hanger is used throughout, although the design varies in detail depending on application. Typical hangers or supports are shown in Figs. 8 and 9.

The expansion tanks are located in the highest portion of the center monitor. Due to the fact that the units are also located high in this monitor the expansion tanks are of the closed pressure type, supplied with air at 5 lb. pressure and wasting air and water through relief valves as required when expansion takes place. The water level, however, is ordinarily maintained so that only air is automatically wasted and replaced when expansion and contraction occurs. The compressed air is supplied from an outside source at 100 lb. pressure and reduced to 5 lb. pressure through a pressure reducing valve into the top of the expansion tanks so as to maintain a 5 lb. minimum pressure inside the tanks.

Fig. 6. Sectional elevation, not to scale, showing the connections from the supply and return pipes in the tunnels to the air conditioning units. In case of repairs the units on either side of the building can be supplied from the tunnel on the opposite side.



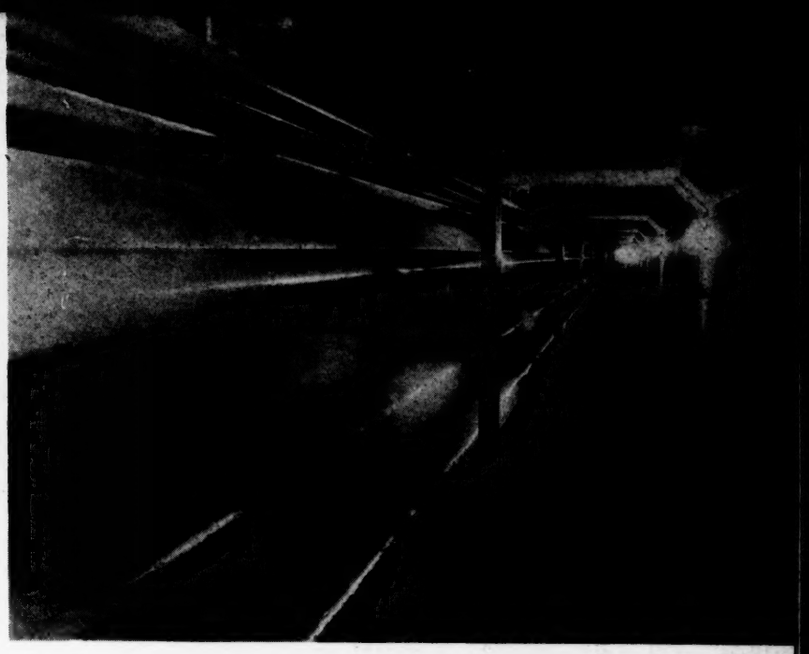


Fig. 7. Looking down one of the pipe tunnels. In the upper left corner can be seen one of the pipe supports illustrated in Fig. 8, while in the center is shown one of the supports detailed in Fig. 9.

Heating System

In order to take care of the wall and window transmission losses, two types of equipment are used. Along the outside longitudinal wall below the windows on the ground floor is a continuous line of direct radiators of either the tubular or wall type. In addition, under the windows on the mezzanine floors a similar line of radiators runs along both the longitudinal walls and one of the under walls. There are four doors in each side, or longitudinal, wall of the building, and two unit heaters are located on either side of each of these doors in order to blanket the doors with warm air to prevent the inrush of cold air. Above each of the end doors—one at each end—there are located two unit heaters of the blower type for the same purpose. Each pair of these unit heaters is controlled by a pneumatic type thermostat located adjacent to the door.

The following schedule shows the heat loss provided for by these different types of equipment in terms of equivalent square feet of hot water radiator at 170 B.t.u. per sq. ft. per hr.:

Cast-iron radiators	40,400 sq. ft.
16 disc type unit heaters, side doors	4,120 sq. ft.
4 blower type unit heaters, end doors	5,290 sq. ft.
Total	49,810 sq. ft.

Ventilating System

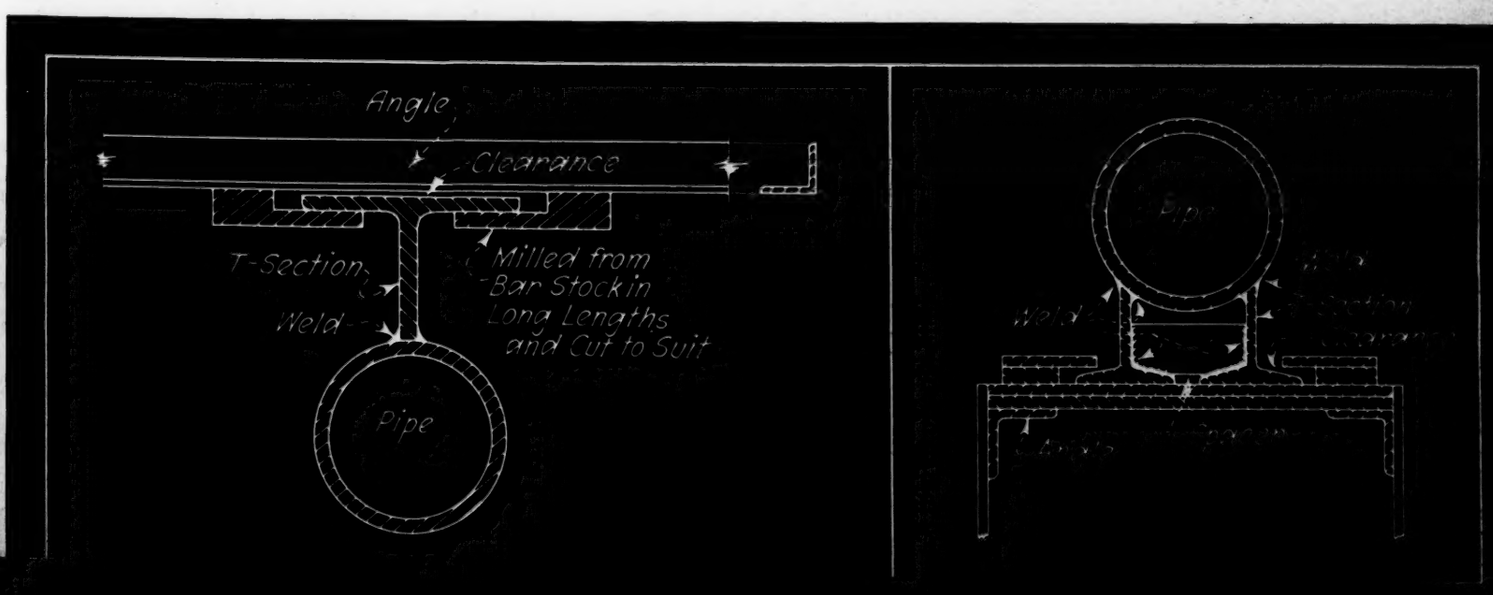
Eighteen separate heating and ventilating systems are provided throughout the building. Each of these consists of an air conditioning unit, supplied with hot water from the distribution system and through which a mixture of recirculated and outside air is supplied to the building under suitable control. In general, 15 of these systems are practically identical except for capacity. Of the remaining three, one supplies the superintendent's office and first aid room, another supplies the hardening room where there are located a number of hardening and tempering furnaces which emit certain gases which make it undesirable to recirculate air from this space, and a third supplies the heater room. The hardening room is kept under slightly less than atmospheric pressure at all times in order thoroughly to exhaust these gases.

The following schedule shows the capacities of these 18 ventilating systems:

Nos. 1-10, inclusive (exclusive of Nos. 3 and 3A)	54,000 c.f.m. each
No. 3	36,000 c.f.m.
No. 3A (Hardening Room)	21,000 c.f.m.
Nos. 11-15	64,000 c.f.m. each
Office system	2,300 c.f.m.
Heater Room System	5,000 c.f.m.

The temperature rise through the air conditioning units is 50 to 150F so that the total heating capacity of the ventilating system is 389,000 sq. ft. of equivalent

Fig. 8. Typical pipe hanger showing how a T-section is welded to the pipe and slides in channels formed from milled bar stock. The T and bar stock are cut in lengths depending on the size of the pipe. Fig. 9. Another welded type of sliding pipe support. These supports can also be seen in the photograph in Fig. 7.



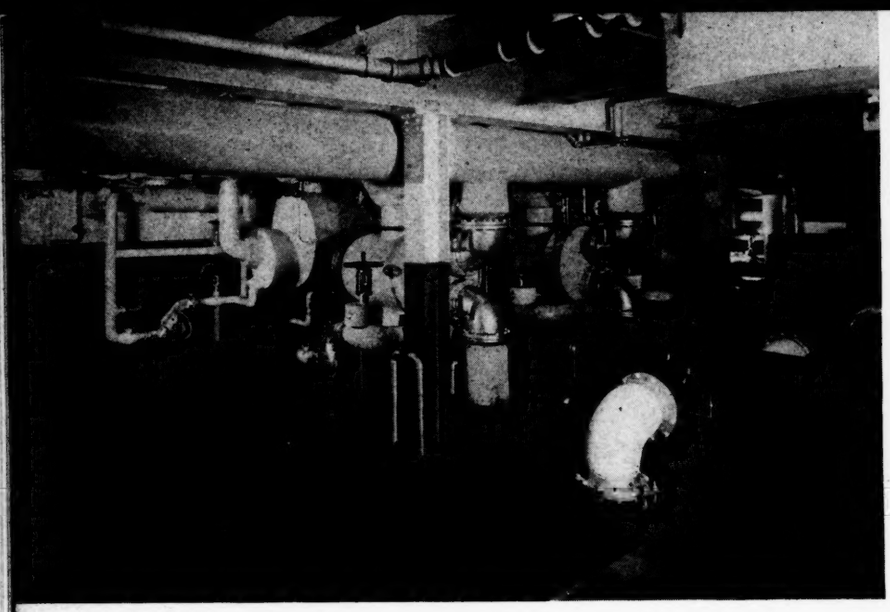


Fig. 10. A partial view of the heater room. Three of the instantaneous water heaters can be seen slightly to the right of the center and one of the water circulating pumps in the extreme right foreground.

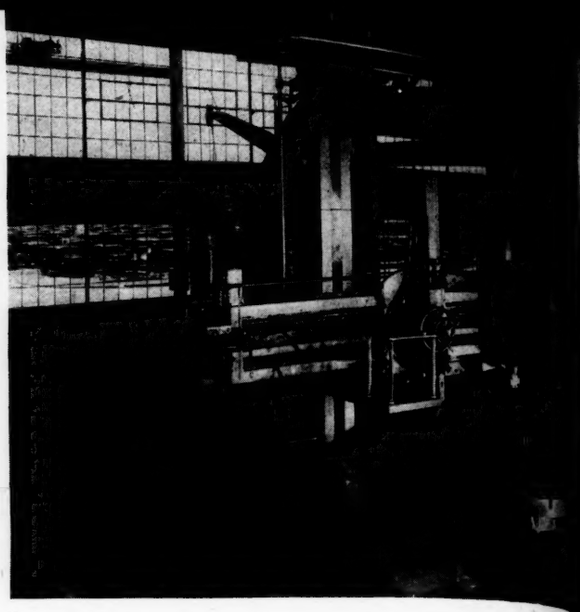


Fig. 11. The wall radiators for counteracting direct heat transmission through the walls can be seen both below and above the lower bank of windows. This view shows one of the large boring mills in the shop.

hot water radiator surface at 170 B.t.u. per hr. per sq. ft. This together with the direct radiators and unit heaters makes a grand total of 438,810 equivalent square feet of hot water radiation in the building.

Controls

The temperature of the water supplying both the direct radiator system and the ventilating system is controlled by a pneumatically operated control which includes an outside element as well as one located in the hot water distribution line. Consequently, when either the inside or outside temperature rises above predetermined points, the steam supply to the instantaneous heater is throttled; conversely, as the inside or outside temperature falls the steam valve is opened.

In connection with each air conditioning unit there is a thermostat located near the floor adjacent to each unit which controls a pneumatic valve in the water line which supplies the coil in that unit. In addition, there is a five-point switch manually operated for adjusting the proportion of outside and recirculated air to the intake side of the heater unit. A thermostat located in the plenum on the inlet side of the coils prevents any mixture of air being drawn into the system below 45F. An insertion type thermostat located in the coil return is set to allow hot water to flow through the coil at any time that the temperature in the coil drops below 45F. This prevents freezing of the coils and operates as an additional limit control.

Most of the air conditioning units have two sets of heating surfaces. The larger supplies air to the main floor whereas the smaller supplies air through a small duct to the mezzanine space. This supplementary smaller coil is controlled by a thermostat located on the mezzanine and not by the one on the ground floor.

Thus the air conditioning of this shop is an outstanding example of modern industrial practice where it is being proved that air conditioning, when soundly conceived, designed and installed, pays profits.

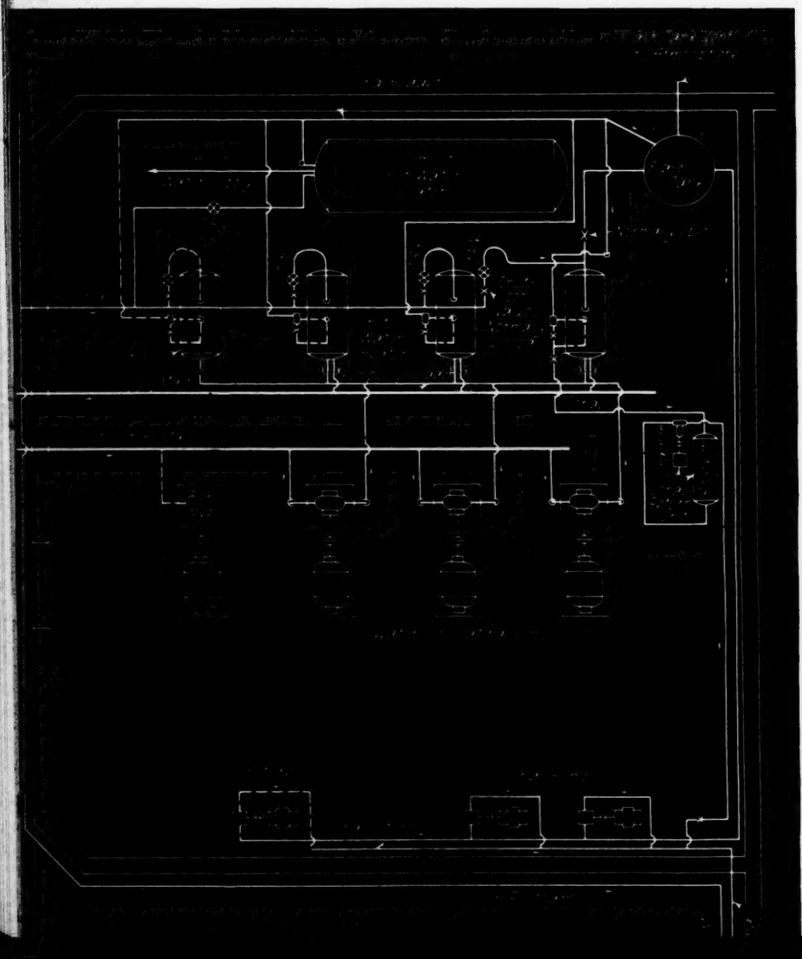


Fig. 12. Schematic diagram, not to scale, showing general arrangement of apparatus in the heater room. The water heater at the right operates under low pressure steam supplied from the flash tank, where the condensate from the high pressure heaters is flashed into steam.

DRUG INDUSTRY

Lederle Laboratories

has hundreds of experimental mice, rabbits and guinea pigs which it finds profitable to keep healthy in an air conditioned environment. Less spectacular, but more essential, is the conditioning of manufacturing spaces and laboratories for the production of various pharmaceuticals.

By JOSEPH F. KERN, Jr.

PROFITS IN AIR

NO. 2 OF A SERIES SHOWING HOW INDUSTRIAL PLANTS PROMOTE PROCESSES AND PROFITS BY SCIENTIFIC CONTROL OF AIR CONDITIONS

IT was nearly 40 years ago that the first installation of air conditioning was made in the drug industry. Since then air conditioning has become recognized as a most essential part of the drug manufacturer's production equipment. In fact, one authority has stated that the importance of air conditioning to the drug industry has increased not progressively but as the square of the years since 1900.

In many of the manufacturing processes in the drug industry air conditioning is absolutely essential if production schedules are to be met and losses in raw material and the finished product are to be avoided. In other processes air conditioning has enabled the drug manufacturer to improve and standardize his product, reduce production costs and turn out a better looking product.

One drug manufacturing company which has found air conditioning to be an absolute necessity in the manufacture of some of its products and an extremely useful help in the production of others is Lederle Laboratories, Inc., of Pearl River, N. Y. This company is one of the foremost producers of biological products for both human and veterinary use. The list of serums, vaccines, gland products and pharmaceuticals made by this company is extremely long. The company is par-

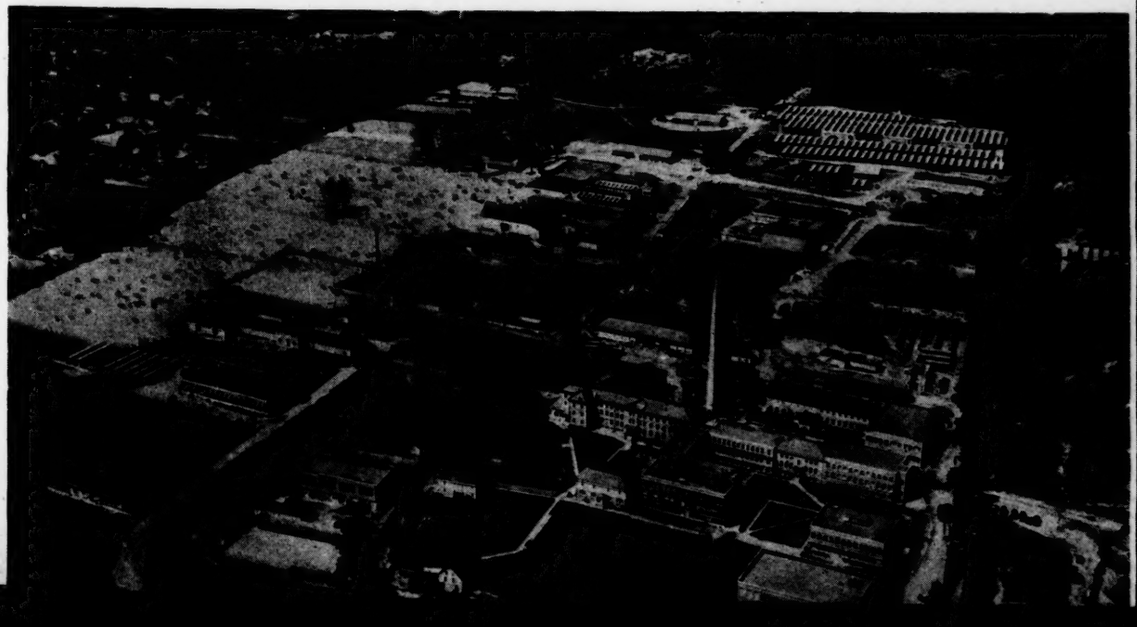


Fig. 1. Aerial view, Lederle Laboratories, Pearl River, New York.

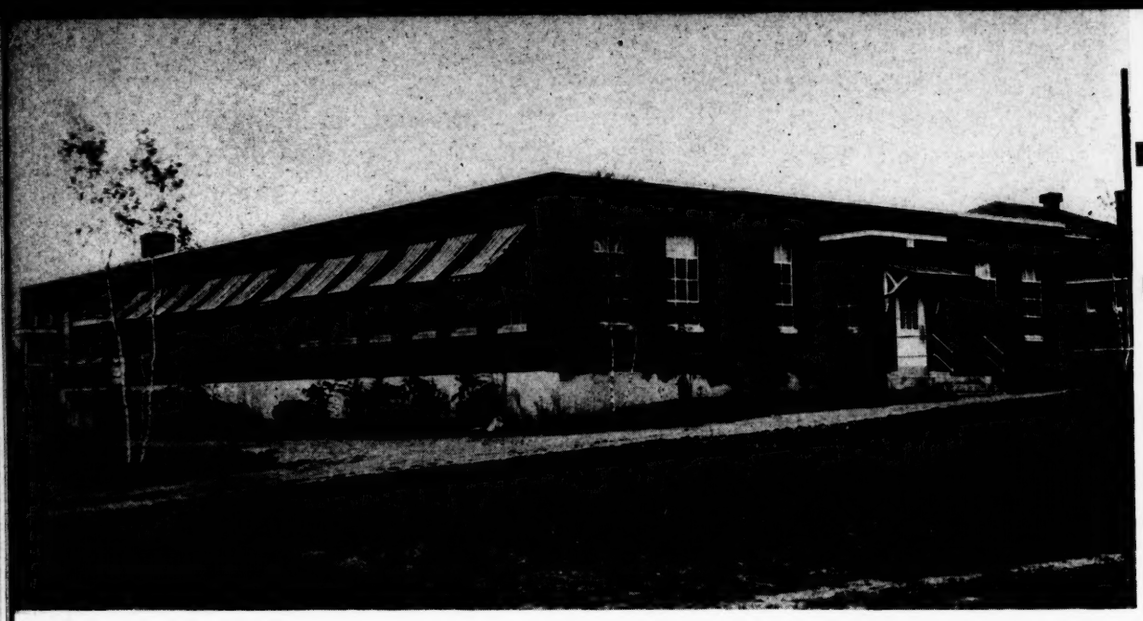


Fig. 2. Small animal house, building 56, which is partially air conditioned.

ticularly well known for its line of serums since it produces more pneumonia serums than all other producers together and is the only manufacturer making all of the 32 types. Other of their products include vaccines for diphtheria, smallpox, typhoid, tetanus, rabies and whooping cough, antitoxins for the prevention or cure of diphtheria, tetanus, scarlet fever, and gas gangrene, and veterinary products such as distemper, blackleg, anthrax, and rabies vaccines, and hog cholera, anthrax, and swine erysipelas serums.

At the present time Lederle Laboratories have air conditioning installations of one kind or another in five of their buildings and are planning additional installations in buildings now under construction. Some of the uses of air conditioning are for maintaining animal health, protection of various serums and gland products, production of tablets and pills and maintenance of comfort.

Animal Health

Practically all drug manufacturers use large numbers of animals for the production, testing and research work in the development of pharmaceutical products. Many types of animals are used in this work including guinea pigs, mice, rats, rabbits, monkeys, dogs, cats, chickens, hogs, horses, and cows. The smaller animals such as the mice, guinea pigs and rabbits are most frequently used in testing and research work.

It is frequently desirable to maintain certain of these animals in air conditioned quarters particularly in those cases where the animals are in a weak condition and where changes in temperature and humidity introduce variables which would affect the results of research work.

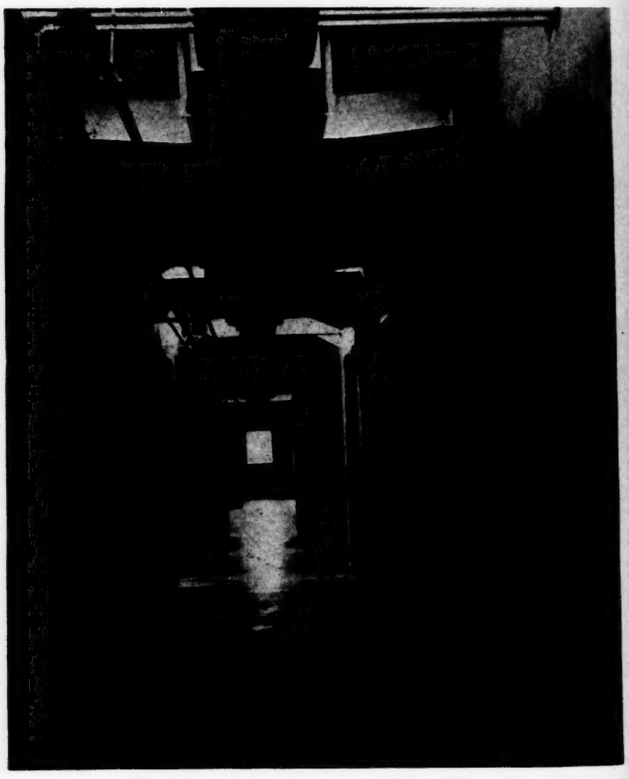
At the Lederle plant at Pearl River one animal house, building 56, is partially conditioned and another, building 57, has a rather complete ventilating system.

Building 56 is used for housing, research and test work on small animals. In this building the air conditions are maintained at approximately 78F and 47% relative humidity throughout the year except during brief periods in the summer when the outside temperature is considerably above normal. The primary reason for conditioning this building is to eliminate the effects of weather conditions on the test animals and also to prevent the animals from catching pneumonia. If the animals become sick and die while under observation, it may mean the loss of considerable time and money as the entire test will have to be repeated.

To condition this building an evaporative cooling system is employed. This system consists of an air washer, heating coils, filters, fans, with the necessary ductwork for distributing the air.

In this system, as in most of the systems installed in the Lederle plant, the filters are on the down-stream

Fig. 3. Central hall in small animal house, Building No. 57. At the ceiling in the hall can be seen the warm air supply duct and the recirculating ducts which supply and remove air from the various animal rooms adjacent to the corridor. Warm air supply duct is on top and is insulated while recirculating air duct is not insulated.



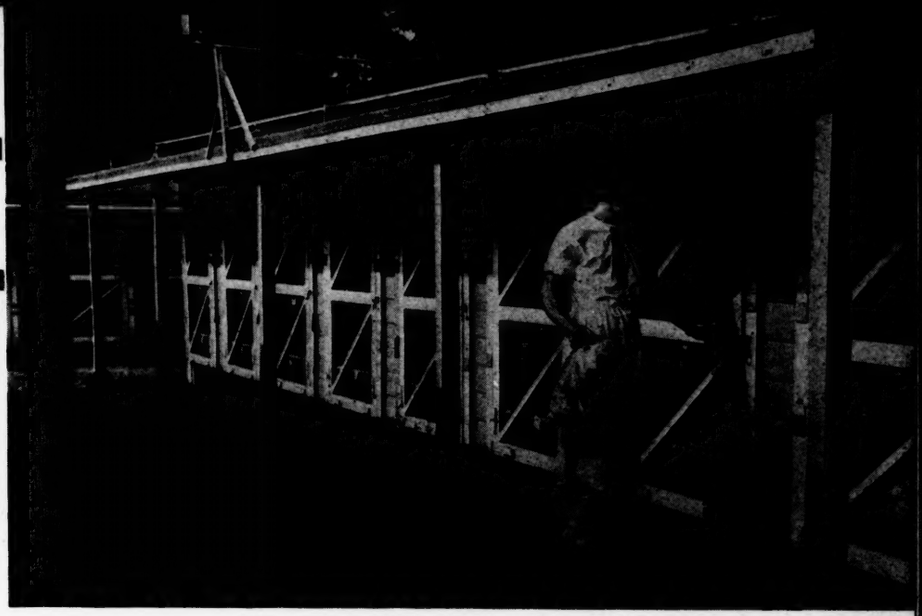
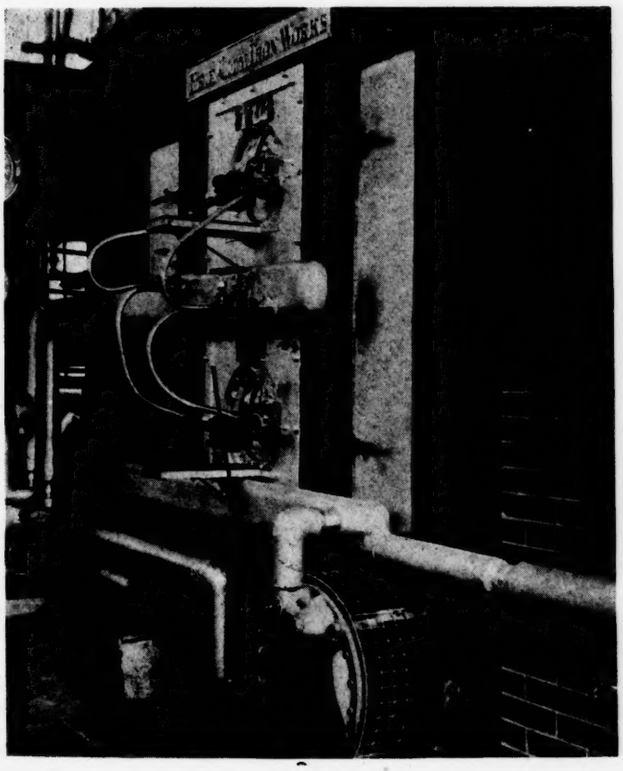


Fig. 4. One of the groups of rabbit huts used for housing rabbits. Note pipe and sprays for roof cooling during the summer.

side of the heating coil. This differs from the usual practice of installing the filters on the up-stream side, which is done to protect the heating coil. The reason for this departure from normal practice is that in most of the installations in this plant it is absolutely essential that all dust be removed from the air. It has been the experience of this company that installation of the filters on the up-stream side does not completely prevent the dust particles from entering the room. It is believed that with the filters installed on the up-stream side of the fan some extremely small particles pass through the filters and are deposited on the heating coil surface.

Fig. 5. Front of the 400 horsepower boiler which supplies steam for heating and process work. Note that the oil burners are installed one above the other instead of side by side. This was done because the boiler is rather narrow.



Since many of these particles will be carbonized when they contact the surface, which is kept at 220F, in time these carbonized small particles may stick together and form a much larger particle which will eventually break loose from the heating surface and enter the distribution system. By placing the filters on the down-stream side of the heater, this occurrence has been eliminated and systems which have been installed for as long as three years show no signs of streaking at the registers and seem to give a much cleaner supply of air. Of course, this procedure requires that the heating coils be cleaned more often than when the filters are installed on the up-stream side, but provisions are made for easy cleaning of the heating coils when the systems are installed.

This building has a heating plant which is not connected to the central heating plant but has its steam supplied by an oil-fired boiler. Most of the buildings in the Lederle plant are supplied with steam from a central steam generating plant but in this instance it was felt that providing a separate boiler would be cheaper than running a steam line to the building since the building is quite a distance from the central heating plant. Also since the building is at a lower level than the heating plant it would be necessary to install a special pump for returning condensate to the boiler plant.

Steam from the gas-fired boiler is supplied to the heating coil at about 5 lb. pressure. Automatic dampers and valves control the temperature of the air entering the distribution system.

During the summer sufficient cooling is obtained from the evaporation of water in the air washer to maintain the building at a comfortable condition at all times.

All of the air supplied the building is distributed through a plenum chamber which is at the top of the center corridor of the building. Ducts from this plenum chamber supply air to registers which are on the inside wall of the various animal rooms. Recirculated air is withdrawn from the rooms through a grille located near the floor and is passed through a concrete duct buried

in the earth beneath the floor of the main corridor.

Building No. 57 is used to house small animals such as guinea pigs, white mice, and chickens used for test purposes. This building also has a separate heating plant. The plant consists of a gas-fired steam boiler together with combined steam radiators and two tempered air ventilating systems. One system takes care of the north end of the building and the other the south end of the building. The ventilating system uses a mixture of recirculated and outside air which is first passed through a heating coil and then through a dry type throw-a-way filter before it is distributed to the various rooms. The temperature of the air entering the room is controlled automatically through a thermostat control.

The air is distributed by exposed ductwork in the halls to ceiling outlets in each room. These ceiling outlets are placed near the windows and the recirculating registers are placed on the upper part of the inner wall. The supply duct is insulated while the return recirculated air duct is uninsulated. The rooms are cooled in summer by circulating water through coils in the duct and by flooding the roof with the circulated water.

Serum Production

Building No. 60 is used for research work and for the production of encephalomyelitis serums and vaccines. Encephalomyelitis is a disease which affects horses and is widespread in this country. It has taken a heavy toll of the horse population throughout the United States and has been known for many years under such terms as forage poisoning, blind staggers, and cerebro-spinal meningitis.

In this building an air conditioning system maintains an 85F temperature and 48% relative humidity when the outside temperature is 95. However, the principal purpose of the air conditioning installation is to supply sterile air. In order to do this all air is filtered on the down-stream side of the fan. By placing the filters in this position there is always a positive pressure in the filter chamber thus preventing in-leakage and consequently the contamination of the air.

Certain rooms in this building must be kept as completely sterile as possible and all of the air supplied to these rooms is filtered a second time before it enters the room. This is done by installing a filter in the branch ducts supplying the room. The filtering of the air is so complete that when a sterile test plate is exposed to the air in these rooms for a half-hour, no colonies will develop on the plate as long as there are no occupants in the room. With one occupant in the room, from 1 to 4 colonies appear on a half-hour exposure.

As a test of the sterility of the air, sterile plates are exposed at all times when the room is being used. Each half-hour the plates are removed and whenever it is found that 5 or more colonies develop in a half-hour exposure, the filters are changed, whether they appear dirty to the eye or not.

There are two air conditioning systems in this building, with the cooling supplied to both by a single, 40 hp., dichlorodifluoromethane condensing unit. The cooling coils are of the direct expansion type and all of the equipment is located in a machinery room in the basement.

Low Humidity Room

A special research room requires a humidity of not over 10%. This low humidity is obtained by an activated alumina dehumidifying unit installed next to the room. This unit merely recirculates the air in the room and removes the moisture. The alumina is reactivated with gas.

Pneumonia Serum

Building No. 54 is used for production of pneumonia serums. There are two air conditioning systems installed in this building, and here again the main problem is to provide completely sterile air. In order to do this, all filters are installed on the discharge side of the fan and all air is passed through an air washer.

Fig. 6. A small special research room in which it is necessary to maintain low humidities. At the right can be seen the activated alumina dehumidifying unit which supplies low humidity air to the room. Photo was taken before installation was complete.

There are 24 small rooms or cubicles located in this building which are used for filling vials with vaccines and serums. Tests in these cubicles show that under normal conditions sterile plates will have no colonies deposited on them in one-half hour when there are no occupants and 1 to 5 colonies with one or two girls working in the cubicle.

The cubicles are small glass-enclosed rooms with a floor area of about 6 x 6 ft. Besides the necessity of supplying completely sterile air to the room, it is also necessary to supply cool air because of the heat released within the small room. The air must remove the heat given off by the two girls, as well as the heat from a 100-watt light and two bunsen burners.

During the summer a temperature of 78F and 50% relative humidity is maintained in these rooms, and in the winter, a 74F temperature and 50% relative humidity is maintained. This comparatively high winter temperature has been necessitated by the fact that air passing through one cubicle has a comparatively high velocity and therefore a higher than normal temperature must be provided in order to overcome the cooling effect of the air. Approximately 400 c.f.m. is passed through each of these rooms.

In some of the cubicles, the products of combustion from the bunsen burners are removed directly by a small stack above the bunsen burners. This stack is connected to the recirculating air duct of the air conditioning system.

The two air conditioning systems in this building are supplied with well water which is at a temperature of about 52F. Each system is made up of an air washer, heating coil, filter, fan and the necessary ductwork. Both systems are located in a single machinery room in the basement.

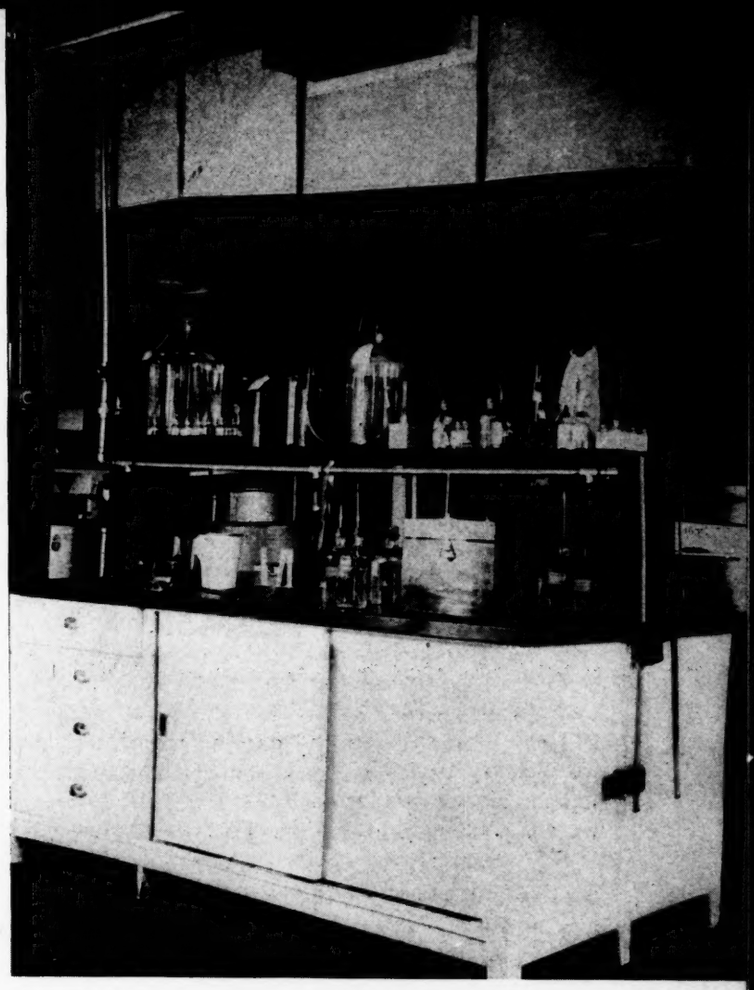


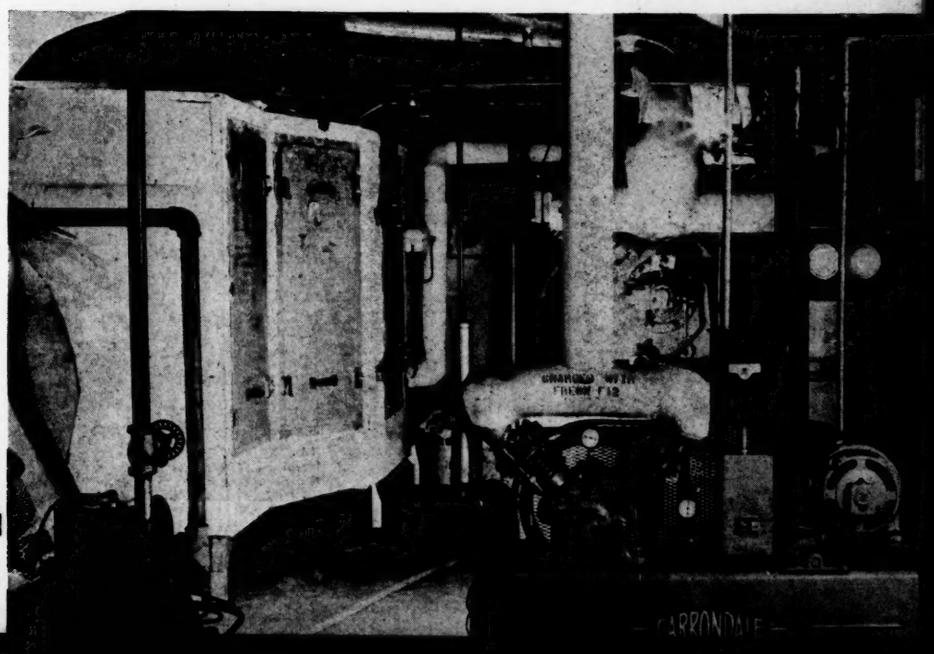
Fig. 7. A corner of one of the laboratories on the ground floor of the Pneumo serum building showing a section of the duct and the register which supplies conditioned air.

Pharmaceutical Building

Building No. 43, known as the Pharmaceutical Building, is mainly used for the production of liver extract, capsules, and pills of various kinds. Because of the variety of operations carried on in this building a number of air conditioning systems are provided.

One air conditioning system supplies conditioned air

Fig. 8. Two of the condensing units and part of the air conditioning system which is used to condition the research building.



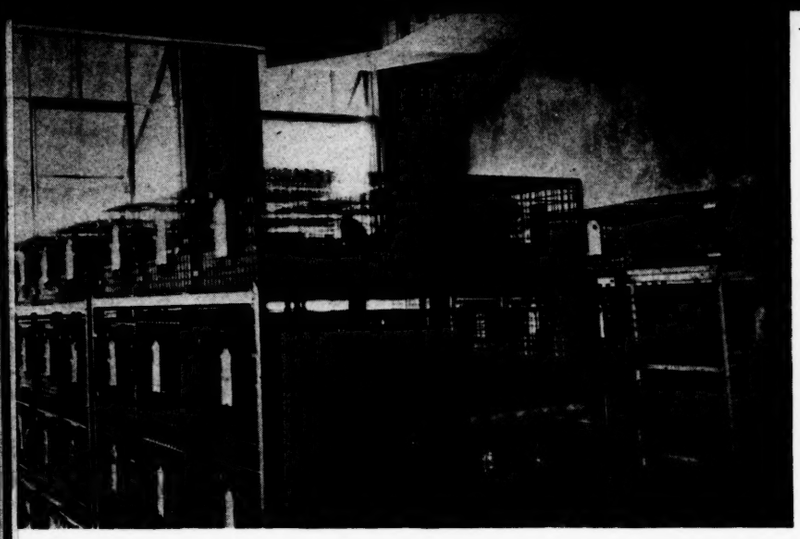


Fig. 9. One of the small animal rooms in the animal building. Near the ceiling can be seen an air inlet duct which supplies conditioned air to the room.

Fig. 10. Research building in which special research work on serum development is carried on. Building is also used for the production of encephalomyelitis serums and vaccines.

to tablet rooms, filling and packing rooms, sterile and test rooms. In these rooms temperatures of 80F and relative humidity of between 35 and 45% are carried, when the outside temperature is 95F with 75F wet bulb.

The principal object of conditioning the sterile rooms is to provide clean air, the control of temperature and humidity being of secondary importance and only to provide more comfortable working conditions.

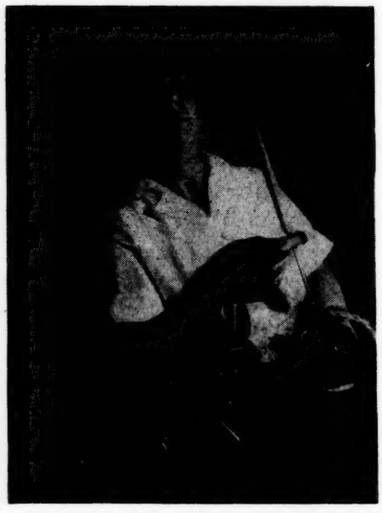
The filling and packing rooms must be air conditioned because gelatin capsules, which are affected by temperature and humidity, are filled and packed in this room.

Pill and Tablet Manufacture

The room which houses the tablet machines is conditioned to keep the moisture content of the drugs at a constant level so as to insure a uniform product and to decrease the cost of production. Pills and tablets are made in either of two forms, with or without an exterior coating.

In the case of uncoated pills, the temperature and relative humidity must be accurately controlled, since if the humidity is too high, the pills and tablets will not dry at the proper rate and the powder that may be used as a surfacing will not adhere. If the humidity is too low, a hard outer crust may form on the pill before the inside has a chance to dry out. This outer crust will chip in time and after the pills or tablets have been bottled, they will give off the internal moisture and frequently stick together. Thus, it can be seen that the rate of drying must be so controlled that the center of the tablet is dried first.

In the manufacture of coated pills, the molded centers are brought in contact with a liquid coating such as chocolate. The number of applications of coating determine the thickness of the final coat. During this process, both the dry bulb temperature and the moisture of the air must be maintained constant. It has been found by a number of manufacturers that a dry bulb temperature of 80F with relative humidity from 35 to 45% prove satisfactory with most tablets. Among the advantages of the use of air conditioning in the manufacture of tablets and pills are a uniform quality, less wastage of material, decrease in cost, and better appearing tablets and pills.



Gelatin Capsule Storage

A second system in this building conditions the capsule storage room. In this instance the system is designed to maintain a temperature of 75F with relative humidity of between 35 and 40% when the outside conditions are 95F dry bulb and 75F wet bulb.

Also located in this building is a room in which liver extract is handled. In this room, the liver extract is exposed to the air and since it has just been previously dried in a vacuum drying machine, a low humidity must be maintained because liver is hygroscopic. Also necessary is a sterile air supply and a temperature of about 80F. Temperatures much higher than this will cause the liver extract to deteriorate. In the rooms where the liver extracts are handled it has been found that the relative humidity should be maintained at not over 10½%. At the present time, two activated alumina units are being installed to supply 3000 c.f.m. of dried air to the four rooms in which the liver extract is handled. These rooms have a volume of approximately 9000 cu. ft. A five-ton condensing unit will be employed to keep the temperature down to the proper point for handling the extract.

A New Method of Controlling Temperatures —The Electronic Temperature Control

By F. F. FISCHER†

Electronic controls are relatively a new development in the building control field and since they offer certain features which are unusual they should be of considerable interest to heating engineers. This article discusses the principle of operation, describes some of the advantages, and points out where such controls may be applied. The author is well qualified to write such an article as he has been associated with the development work on this type of control for a number of years.

THE average electric temperature control consists primarily of a temperature sensitive element and a switch for making or breaking an electrical circuit. The simpler controls have the switch directly connected to the temperature sensitive element while others employ elaborate mechanical movements to operate the switch.

The temperature sensitive element may be simply a solid bar which varies its length in accordance with temperature changes, a bimetallic strip, a bellows filled with gas or liquid, a thermocouple or a resistance wire. While the characteristics of controls using most of these elements are fairly well known, the resistance wire type is a new development and is therefore comparatively unknown. Because this type of control offers certain features which are quite unusual, it should be of considerable interest to heating engineers.

The operation of resistance wire control systems, or electronic control systems, as they are frequently called, is based upon the fact that an electrical conductor will change its electrical resistance in accordance with its temperature. As the temperature rises the resistance will also rise and as the temperature falls the resistance will fall.

Because of this fact it is possible to use a short length of wire as the temperature sensitive element and because there are no moving parts in the element, vibration, moisture or wear will not affect the operation of the control system. However, in order to utilize this characteristic of wires it is necessary to employ some means of measuring the resistance changes. These changes are exceedingly minute and sensitive apparatus must be employed to detect the changes.

The actual method employed is rather ingenious. Two resistance wires are used, one placed outside the building and one on a typical radiator inside. These two resistance wires are then balanced so that they have equal resistances and are connected to an electrical instrument which will detect when they fall out of balance. When this occurs the instrument will immediately operate a switch which can be made to cause the heating system to send heat to the radiators.

The electrical instrument used to detect the unbalance of the resistances consists of a modified Wheatstone bridge, electron vacuum tubes and a sensitive relay. As soon as the resistance wires become unbalanced due to a temperature change, a current is sent from the Wheatstone bridge to the electron vacuum tubes where it is amplified so that it can throw the relay switch, which in turn operates the heat valve.

If desired, this electronic control circuit can be made so sensitive that it will operate on a 1/10F change in temperature. The sensitivity of this type of control can be demonstrated by passing the open hand across one of the resistance units. It will be found that the radiant heat of the hand will be enough to operate the sensitive control.

Since all wires are affected by temperature changes, it is necessary to employ some method of neutralizing the resistance change in the wires connecting the control elements with the balance indicator. This is done by using wires with a comparatively high resistance in the control elements

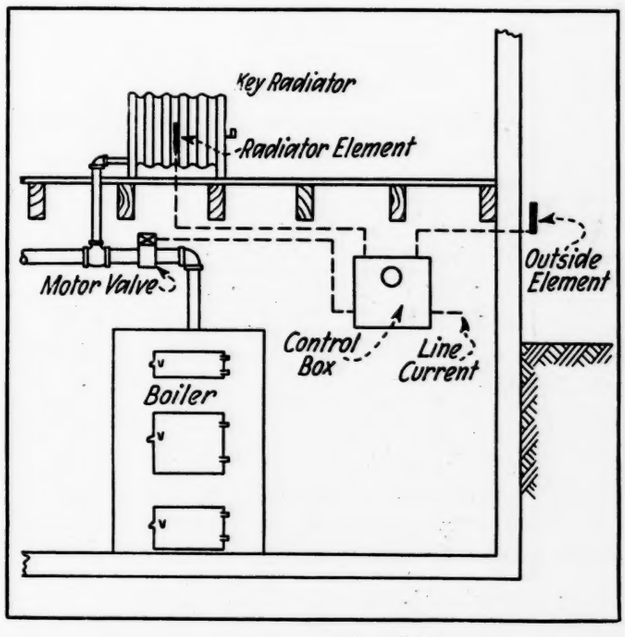


Fig. 1. Schematic diagram of arrangement of typical electronic control system as applied to simple steam heating system.

†Fischer-Smith, Inc., West Englewood, N. J.

and ordinary low resistance bell wire for connecting the elements and the balance indicator. Since the elements have considerably more resistance than the bell wires a change in temperature of the connecting wire has little effect on the total circuit resistance.

When used to control the heating system of a building the outside resistance wire is installed at a point on the outer wall which is representative of the weather affecting the building. This element is housed in a small weather-proof box and is mounted so that it does not receive the direct rays of the sun, but is exposed to wind, rain and snow just as the building is.

The inside element which is also a small piece of wire may be contained in a space the dimensions of an ordinary thimble or can be spread over an area to register an average temperature. It may be concealed beneath the wall paper when used as a thermostat or placed on a radiator to control radiator temperature.

When used to control the radiator temperature the element may be simply strapped to the outside of the radiator or inserted in the radiator. When desired, the wire element may be divided into four or more sections which feel the difference and total the result, sending to the control box a signal which is the average of the radiator output.

In general, the operation of the control systems when used with a radiator element depends upon maintaining a fixed radiator temperature for a given set of outside weather conditions.

In operation when the outside temperature falls the control system is thrown out of balance and the balance indicator operates the relay to send more heat to the radiators. As soon as the radiator temperature increases to the proper point the system is again balanced at the new outside temperature and the heat supply is shut off or decreased. If the outside temperature remains constant but the radiator temperature falls the balance of the system is again upset and more heat must be supplied to bring the radiators to their proper temperature to meet the building heat loss.

The control of the heating system may either be of the on-off, pulsating or modulating type and either the fuel firing device such as gas or oil burner or stoker or a valve on the heating main may be controlled.

When this type of control system is applied to a heating system the radiators are kept above room temperature and reach maximum temperature only when the outside temperature falls to design conditions. Some heat is given off at all times and it is frequently impossible to tell when the steam is *on* or *off* by feeling the radiators.

For any particular building there is a relation between the outside weather conditions and the radiator surface temperature needed to maintain a constant inside temperature. This relationship can be shown by plotting the radiator temperature against the outside temperature as in Fig. 2. While this does not give an exact representation of the conditions, since the radiator temperature is proportional to not only the outside temperature but also to other conditions such as wind and sun, it does give an indication of the relationship.

When the control is applied to a particular building the control must be adjusted so that the radiator temperature is high enough to supply sufficient heat when the outside temperature is at design conditions. For example, if a heating system was designed to have a radiator temperature of 215F when the outside temperature is 0F the control system must be adjusted to maintain the radiators at this temperature when the outside temperature was 0F.

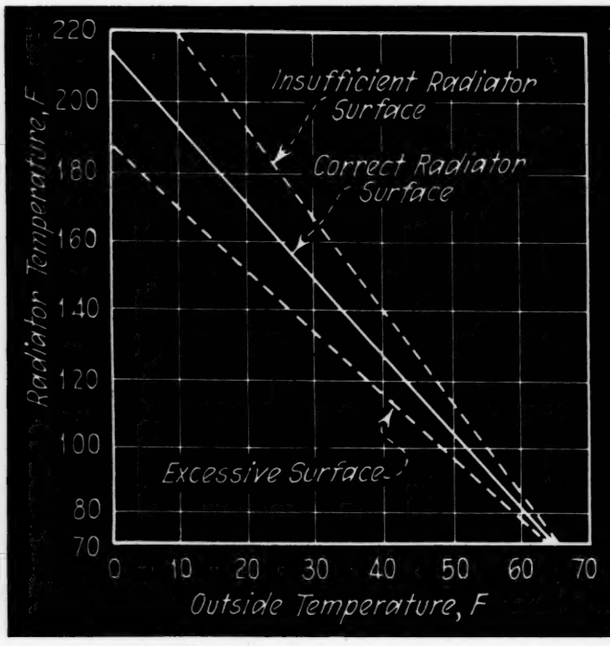


Fig. 2. Solid line represents ratio of outdoor to radiator temperature maintained by electronic control when the proper amount of radiator surface has been installed. Dotted lines represent typical settings to compensate for insufficient or excessive radiator surface or for changes in building exposure or heat loss of building.

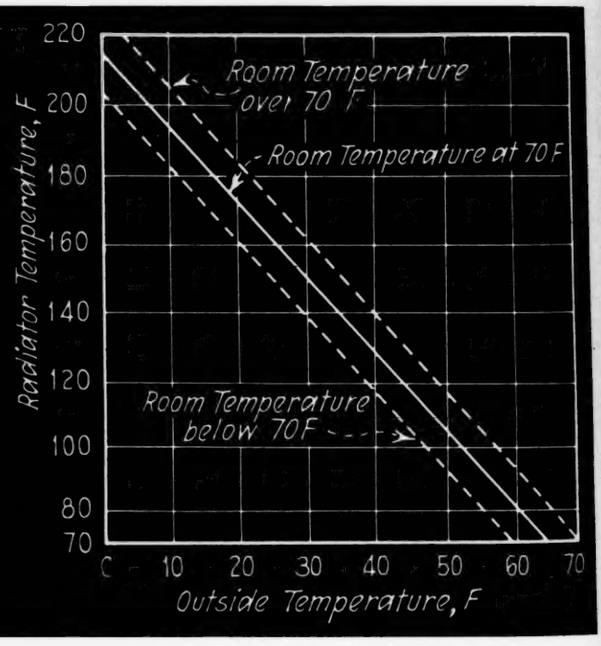


Fig. 3. Solid line represents ratio of outdoor to radiator temperature maintained by electronic control to give a 70F room temperature. Dotted lines represent typical ratios to maintain temperatures of over or under 70F. They represent conditions maintained during the night or during heating up period in morning.

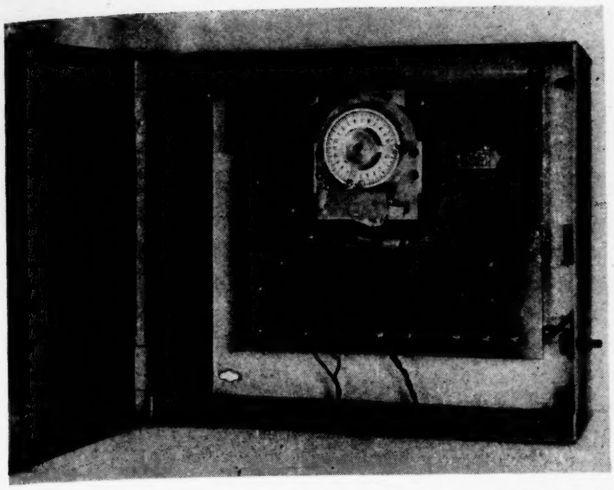


Fig. 4. The interior of electronic control box. At the top is a tubular light which operates when the box is open. Beneath this is a time clock. while in the lower part can be seen the adjustments for daytime control and heating up.

However, if the control was applied to a building which had insufficient radiators to heat the building with a 215F radiator at design conditions then the control would have to be adjusted to maintain a higher radiator temperature when it was 0F outside. This is shown in curve *B,* Fig. 1.

If the building had an excess of radiators then the control would have to maintain the radiators at below 215F when outside was 0F. See curve *C,* Fig. 2.

To make these adjustments so that the control fits the building an exposure adjustment is provided which changes the resistance in the bridge circuit.

This adjustment may also be used to correct for changes in the building construction or exposure. If the building is insulated or has storm windows added after the control system was installed the heat loss of the building will be changed and the exposure adjustment must be changed. Another condition requiring a change in exposure adjustment is a change in exposure due to erection or demolition of nearby buildings.

Occasionally it is necessary to vary the interior temperature of the building. This is done by changing the inside temperature adjustment. The effect of making such an adjustment is to decrease or increase the radiator temperature a given amount over the whole range of outside temperatures. The increased or decreased radiator temperature in turn results in an increased or decreased room temperature. Fig. 3.

This interior adjustment knob regulated the resistance of the wire attached to the radiator so that the radiator will have to produce more heat and further raise the temperature of the wire to establish balance in the system. In like manner a lowering of room temperature may be obtained.

This adjustment is also used for maintaining a lower night temperature in the building and also for rapid heating in the morning. When this is desired a time clock is employed to select these operations automatically.

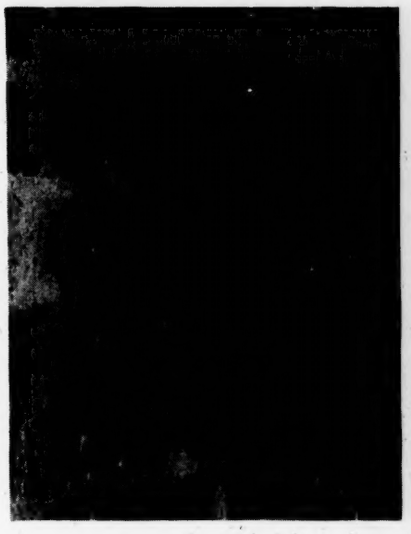
It should be noted that the outside control element responds to weather changes rather than temperature changes alone. This is so because the resistance wire in the element is heated by the current flowing through it to a degree somewhat above the outside air temperature. Because of this, heat will be radiated from the element and the wind will remove some heat thus lowering the temperature. The control will assume a temperature somewhat above the outside air temperature depending upon outside weather conditions and thus gives a measure of these conditions.

It should also be noted that the power control relay may be held *on* by an electrical lock-in circuit which shuts off the heat supply in event of power failure.

Wiring such a control system is easily done, since only one low voltage bell wire has to be used to connect the element with the control box. Also connected to this box are the outside power line and the power line to the heat control.

About the only maintenance cost with this type of control system other than the cost of electricity is the cost of two electron tubes from time to time. It is desirable although not necessary to replace the tubes at the start of each heating season. These tubes cost about two dollars and are obtainable in any radio store.

In concluding this article it might be well to sum up the more outstanding features of this type of control. First of all it can be made extremely sensitive—to respond to temperature changes of 1/10F if desired. Second, it has only one moving part—the relay. Third, it is easily installed since the wiring from the elements to the control box is low voltage bell wire. Fourth, the outside element responds to weather changes and not merely to temperature changes. Fifth, the control can be applied to any type of heating system and, sixth, it is comparatively low in cost.



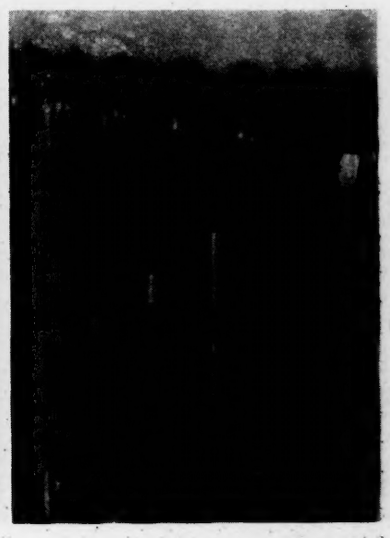


Fig. 5. Outside control element which is installed at a point on the outer wall representative of the weather affecting the building.

Fig. 6. Control radiator showing inside control elements strapped onto the surface. Radiator is connected to an experimental heating system using hot water.

The Gilchrist Air Conditioning Chart for Solving Air Mixture Problems

By FRANCIS G. GILCHRIST

The accompanying psychrometric chart, presented for the first time on these pages, substitutes a single point for what is a straight line on the conventional psychrometric chart. As a result, the Gilchrist chart is much simplified and provides space for the inclusion of data not usually provided.

THE psychrometric charts in use today are drawn with four or more sets (pencils) of lines: one set for dry bulb temperatures, one set for vapor content (specific humidity) and dew point, a third set for wet bulb temperatures and total heat content, and a fourth set for relative humidities. Some charts add a fifth pencil of lines for the specific volume of the air. The Air Conditioning Chart presented here in Fig. 1 substitutes a single point for each straight line on a psychrometric chart, and a single line for each set or pencil of straight lines. As a result the presentation of the data is simplified and space is provided for the inclusion of data not usually given; for example, for effective temperatures and *heat ratios*. Uses of the latter in solving problems in air conditioning will be described presently. The reading of the Air Conditioning Chart is more rapid than that of the usual psychrometric chart; furthermore, the new chart simplifies the solution of certain fundamental problems of air conditioning.

In principle the Air Conditioning Chart is a nomogram, and is read with the aid of a straightedge. For example, let a line be drawn across the chart intersecting the temperature axis at 75F and tangent to the curve of 50% relative humidity. (See the line labelled *room air*, Fig. 2.) One reads directly from the line, dry bulb temperature 75F, sensible heat 18.1 B.t.u., relative humidity 50%, dew point temperature 55F, specific humidity (often called *absolute humidity*) 64 grains of vapor per pound of dry air, specific volume 13.52 cubic feet per pound of dry air, and an effective temperature (in still air) of 70F.

The chart is based on the equation: sensible heat + latent heat = total heat (but see note at the end of the article). Sensible heat scales downward on the temperature axis, axis A. Latent heat scales upward on the parallel axis, axis B. As a result it follows that all lines which may be drawn across the chart parallel to each other represent air conditions of the same total heat content. Hence parallel lines are of the same wet bulb temperature. To read wet bulb temperature, one lays a second straightedge across the chart (or draws a second line) parallel to the first, but tangent to the curve of 100% relative humidity. By doing this it will be found that the wet bulb temperature corresponding to a dry bulb of 75F and relative humidity of 50% is 62F.

The *heat ratio lines* are an important feature of the Air Conditioning Chart. Lines have been drawn in the text figure at 75F and 50%, and at 90F and 50% to represent the condition of room air and outdoor air respectively. Now it will be found that these two air conditions differ in sensible heat content by 3.6 B.t.u. per pound of dry air. (Sensible heat may be read along the temperature axis, or it is 0.241 times the difference of temperature.) The two airs differ in latent heat content by 6.7 B.t.u. per pound of dry air. (Latent heat may be read along axis B by using the same scale used in reading sensible heat along axis A.) The two air conditions therefore differ in total heat content by 10.3 B.t.u. per pound of dry air; and the ratio of sensible heat difference to total heat difference is $N = 3.6/10.3 = 0.35$. With the aid of the chart one need not have gone through this computation, for the lines representing the two air conditions intersect on the 0.35 heat ratio line. In general, any two air condition lines which intersect on a given heat ratio line differ in sensible heat and in total heat in the ratio indicated.

Total heat is most easily obtained by dividing the sensible heat by the heat ratio. In the example just given, the sensible heat difference divided by the heat ratio gives a total heat difference of $0.36/0.35 = 10.3$ B.t.u. per pound of dry air.

Let us now make use of the Air Conditioning Chart in solving a problem in the summer air conditioning of a room. Assume that the *outside air* required for ventilation is to be mixed with a certain amount of *return air* from the room and then passed over the cooling coils. The *conditioned air* which is thus obtained is then to be mixed with a quantity of *recirculated air* from the room, in order that the *supply air* which actually enters the room may be at a certain specified temperature.

Let the design conditions be as follows:

Inside (room) air temperature	75F
Inside relative humidity	50%
Outside air temperature	90F
Outside relative humidity	50%
Sensible heat load of room	18,000 B.t.u. per hr.
Latent heat load of room	6,000 B.t.u. per hr.
Outside air required for ventilation	400 c.f.m.
Temperature of supply air entering room	64F

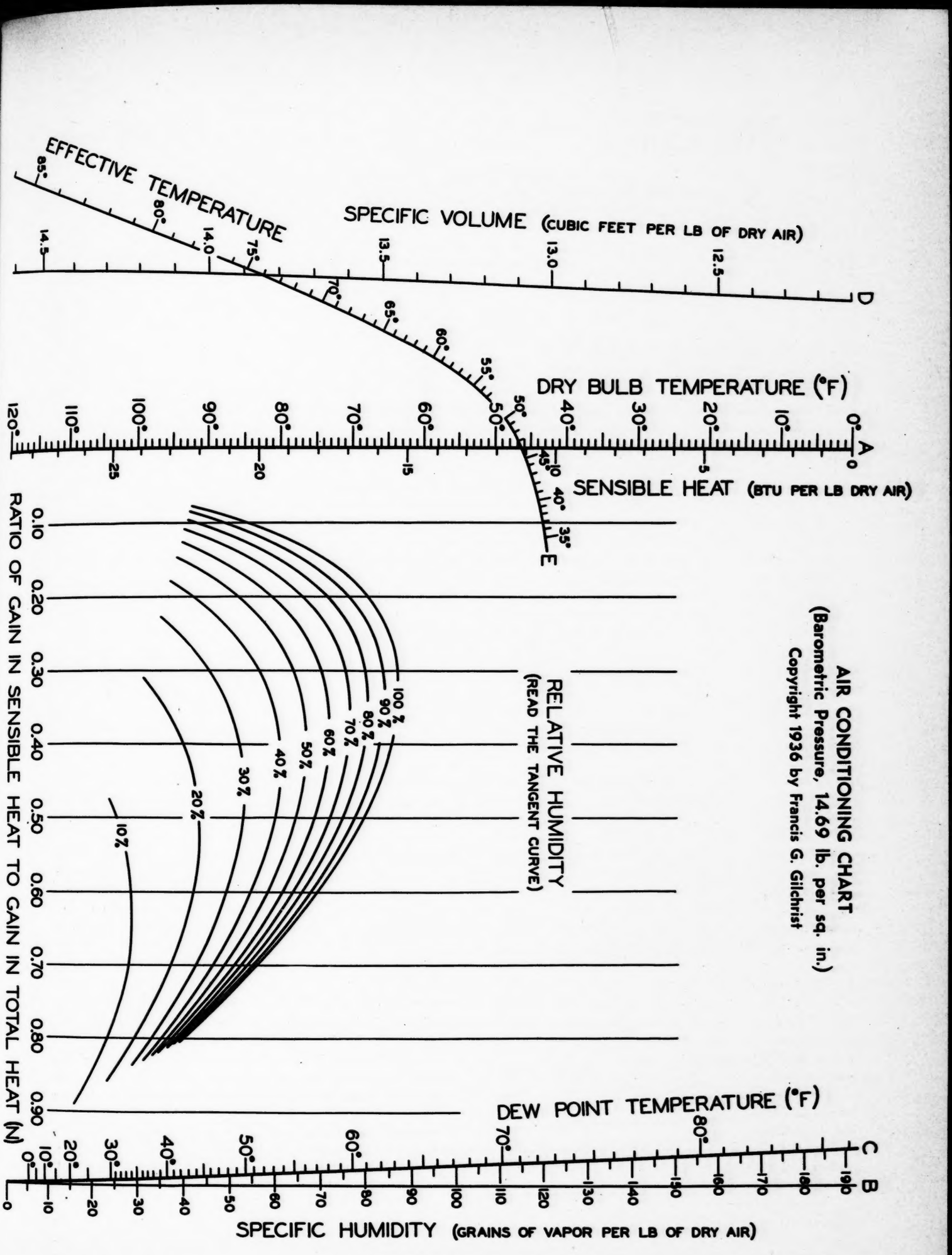

AIR CONDITIONING CHART
(Barometric Pressure, 14.69 lb. per sq. in.)
Copyright 1936 by Francis G. Gilchrist
EFFECTIVE TEMPERATURE
SPECIFIC VOLUME (CUBIC FEET PER LB OF DRY AIR)
DRY BULB TEMPERATURE (°F)
SENSIBLE HEAT (BTU PER LB DRY AIR)
RELATIVE HUMIDITY
(READ THE TANGENT CURVE)
RATIO OF GAIN IN SENSIBLE HEAT TO GAIN IN TOTAL HEAT (N)
DEW POINT TEMPERATURE (°F)
SPECIFIC HUMIDITY (GRAINS OF VAPOR PER LB OF DRY AIR)

Fig. 1. The Gilchrist psychrometric chart.

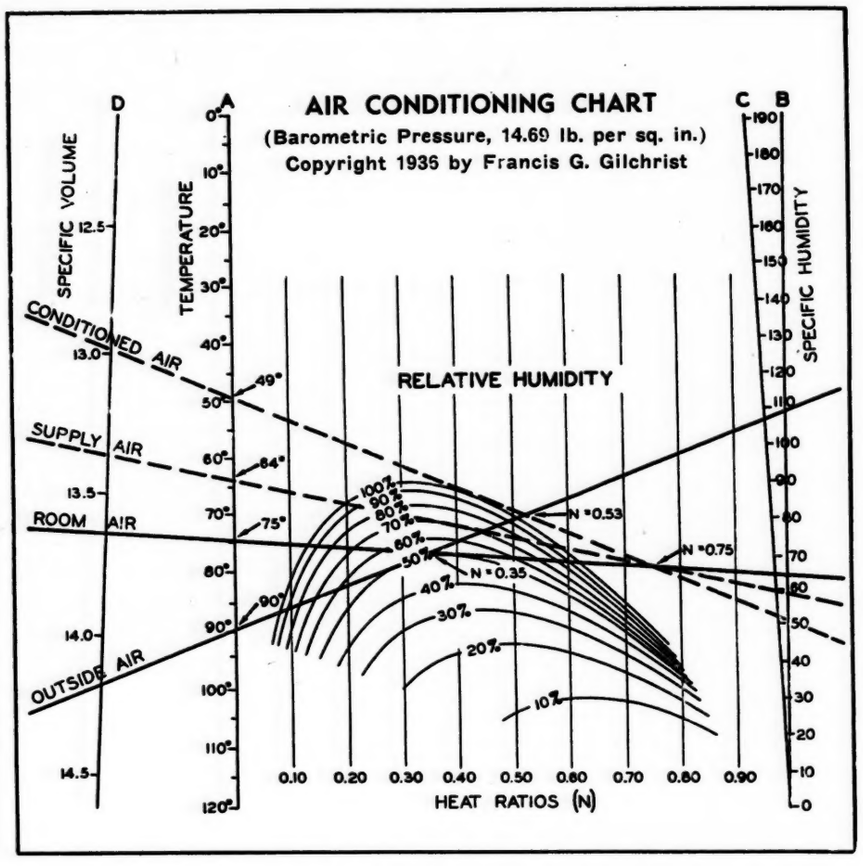


Fig. 2. Solution of a typical problem of a typical air conditioning chart.

The problem is to find the amount and condition of the (a) conditioned air leaving the cooling coils; (b) supply air entering the room; (c) recirculated air from the room; (d) outside air used; and (e) return air from the room which is conditioned along with the outside air. The problem is also to find the amount of refrigeration required and the weight of moisture which is to be taken from the room during the process of air conditioning.

(1) Our first step is to draw on the chart the lines for the outside air condition, 90F and 50%; and for the specified inside room air condition, 75F and 50%. (See Fig. 2.) Next we note that the total heat load of the room is 18,000 + 6,000 = 24,000 B.t.u. per hour, and that the heat ratio is N = 18,000/24,000 = 0.75. We plot this point on the inside air condition line. Any condition of the conditioned air or supply air which will serve to maintain the air of the room at the specified inside air condition and against the specified heat load will be represented on the chart by a line passing through this point.

(2) To find the condition and quantity of *conditioned air* which leaves the cooling coils, draw a line through the heat ratio point, N = 0.75, and tangent to the relative humidity 100% curve. The temperature of the conditioned air is immediately found to be 49F. The weight of air which must be conditioned at this temperature in order to balance the heat load of the room is the sensible heat load of the room divided by the difference in sensible heat content of the room air and conditioned air. (The latter figure may be read from the chart, or obtained by multiplying the difference in temperature by 0.24.) The weight of air which must be conditioned is 18,000/6.2 = 2,900 pounds per hour. Its volume is the weight of air multiplied by the specific volume and divided by sixty, or 2,900 × 13.0/60 = 630 c.f.m. (The specific volume is read from the chart.)

(3) The condition and quantity of *supply air* entering the room is determined by the requirement that the air shall be at 64F (that is, not more than 11F cooler than the room air). To represent the supply air draw a line on the chart through the temperature 64F and the heat ratio point N = 0.75. The relative humidity indicated is 67%. The weight of the supply air is, as in the case of the conditioned air, the sensible heat load of the room divided by the difference in sensible heat content of the room air and supply air. It is 18,000/2.65 = 6,800 pounds per hour. The volume of the supply air is the weight of supply air multiplied by the specific volume and divided by sixty. It is 6,800 × 13.38/60 = 1520 c.f.m.

(4) The condition of the *recirculated air* from the room is, of course, the same as the room air, namely, temperature 75F and relative humidity 50%. Its weight is the difference between the weight of the supply air and that of the conditioned air, or 6,800 — 2,900 = 3,900 pounds per hour. Its volume is its weight multiplied by the specific volume and divided by 60, or 3,900 × 13.67/60 = 890 c.f.m.

(5) The condition and volume of the *outside air* are given in the specifications. They are, temperature 90F, relative humidity 50%, and volume 400 c.f.m. The weight of the outside air is the volume divided by the specific volume and multiplied by sixty, or (400/14.2) 60 = 1700 pounds per hour.

(6) The condition of the *return air* from the room which is added to the outside air before it passes over the cooling coils is the same as the specified inside condition of the room air; namely, 75F and 50%. Its weight is the difference between the weight of the conditioned air and that of the outside air provided for ventilation; namely, 2,900 — 1,700 = 1,200 pounds per hour. (The weight of the moisture removed from the conditioned air is here neglected.) Its volume is the weight multiplied by the specific volume and divided by sixty. It is 1,200 × 13.67/60 = 273 c.f.m.

(7) To find the amount of refrigeration required, one may add the total heat taken from the return air and the total heat taken from the outside air by the cooling coils. The total heat taken from the return air is the difference in the sensible heat content of the return air and conditioned air, divided by the heat ratio,

and multiplied by the weight of the return air; that is, (6.25/0.75)1,200 = 10,000 B.t.u. per hour. The total heat taken from the outside air is similarly the difference in sensible heat content of the outside and conditioned air, divided by the heat ratio (read at the point where the lines for outside air and conditioned air cross) and multiplied by the weight of outside air. It is (9.85/0.53)1,700 = 31,500 B.t.u. per hour. The overall refrigeration load of the air which is conditioned is, therefore, 10,000 + 31,500 = 41,500 B.t.u. per hour. Expressed in tons of refrigeration, this is 41,500/12,000 = 3.46 tons.

The refrigeration load is even more simply found by adding the total heat load of the room, and the difference in total heat of the outside air used for ventilation and an equivalent amount of room air. The latter is the difference in sensible heat content of the outside air and room air divided by the heat ratio (read at the point where their lines cross), and multiplied by the weight of air used for ventilation. The refrigeration required is therefore 24,000 + (3.6/0.35) 1,700 = 41,500 B.t.u. per hour.

(8) The water which is removed by condensation from the air which passes over the cooling coils is the vapor content of the return air plus the vapor content of the outside air minus the vapor content of the conditioned air. The vapor content of the return air is the vapor content of one pound of return air (its specific humidity) multiplied by the weight of the return air; similarly for the outside air and conditioned air. In short, the water removed by condensation is 64 × 1,200 + 106 × 1,700 — 51 × 2,900 = 109,000 grains, or 15.6 pounds per hour.

Construction

Strictly speaking, the chart is constructed on the basis of heat of the air plus heat of the vapor equals enthalpy. The heat of the liquid, latent heat, and super heat are all included under the heat of the vapor. Heat of the air (h_a) scales downward on axis A. Heat of the vapor (h_v) scales upward on axis B. Temperature (t) is scaled on axis A according to the equation $h_a = 0.241$ t. Specific humidity (w) is scaled on axis C, the position and scale of which is given by the formula $h_v = (1059 + 0.45\ t)\ w$. Vapor pressures (e) (not shown on the finished chart) were then scaled on axis C according to the relation $0.623/w = 14.69/e - 1$. Relative humidity lines were entered on the basis of vapor pressures from the steam tables of Moyer, Calderwood, and Potter. The chart checks closely with Goodenough's psychrometric table. Specific volumes were entered from Goodenough's table. Effective temperatures are from the empirical data of Yaglou and Miller.

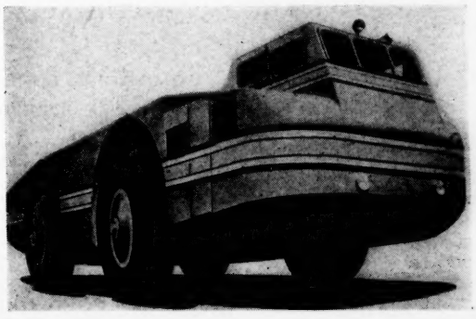
Antarctic Snow Cruiser Heated with Diesel Engines

Although they will be stationed for three years in the coldest spot in the world, the four scientists who will work and live aboard the Snow Cruiser—the $150,000 survey and research unit of the U. S. Government's forthcoming Antarctic Expedition—are not worrying about keeping warm.

The staff of the Research Foundation of Armour Institute of Technology, designers of the Snow Cruiser, has made adequate provision for heating. Both of the two 150 hp. Cummins Diesel engines which, directly connected to traction-type generators, will furnish motive and auxiliary power, will be equipped with a radiator cooling system. The anti-freeze solution, heated by circulation through the engines, will be piped to radiators in the various compartments of the Cruiser, assuring comfortable room temperatures at all times.

The Pull-Standard Car Manufacturing Company built the Snow Cruiser for the Research Foundation, which is loaning it to the government for the coming expedition.

Dr. Thomas C. Poulter, scientific director of the Research Foundation and second in command of the last Byrd Antarctic Expedition, will command the Cruiser and he will be accompanied by three other scientists. They will study various natural phenomena and map and explore vast areas of Antarctica for the government.



The Snow Cruiser is 55 feet long and loaded, it will weigh approximately 180,000 pounds. It will contain storage space for a year's food supply, 2500 gallons of Diesel fuel oil and 1000 gallons of gasoline, living quarters, galley, radio station, dark room, engine room, machine shop and scientific laboratory.

The two Diesel-electric units will furnish power to the traction motor on each of the ten-foot, rubber-tired wheels in any combination of one, two, three or four wheels. By means of an ingenious arrangement of hydraulic lifts, the wheels will be retractable and the Cruiser will be able to span 15-foot crevasses in the ice. The steering mechanism will be located in the central control room and will consist merely of two levers, one controlling the rear wheels, the other, the front wheels. The Cruiser will be able to turn around in its own length, move laterally at an angle and climb 37 per cent grades. It will make between 10 and 30 miles an hour and will have a cruising range of 5,000 miles.

Moored on the top deck will be a five-passenger plane, fully equipped with cameras and scientific instruments. The plane will operate as far as 600 miles from its mobile base.

Precautions Necessary in Connecting Up Hot Water Boilers

By HARRY M. SPRING

HEATING buildings and water for domestic service by small, individual boilers is neither out of date, nor does the method appear likely to become so in the near future. Many improvements and variations in design, such as forced circulation, and redistribution of boiler heating surfaces crop up now and then, but the fundamental installation remains practically unchanged.

The high pressure steam boiler is considered a source of potential danger—at least if in the hands of an incompetent operator. Many states have enacted engineer's license laws requiring a strict examination of the prospective engineer's ability and experience before allowing him to operate a steam boiler. Also, most states have strict inspection laws to enforce rules for safe operation and maintenance of steam boilers and appliances.

The little hot water boiler is often forgotten as a source of danger, although it can be *quite a destructive animal.* Almost every week during the heating season, one may read news accounts of the explosion of a hot water boiler somewhere in this country.

Several states have expanded their steam boiler laws to cover the hot water boilers and rightly so. Excellent work in preventing accidents is also being done by some insurance companies, but many of these boilers are not insured, and the owner does not receive this service.

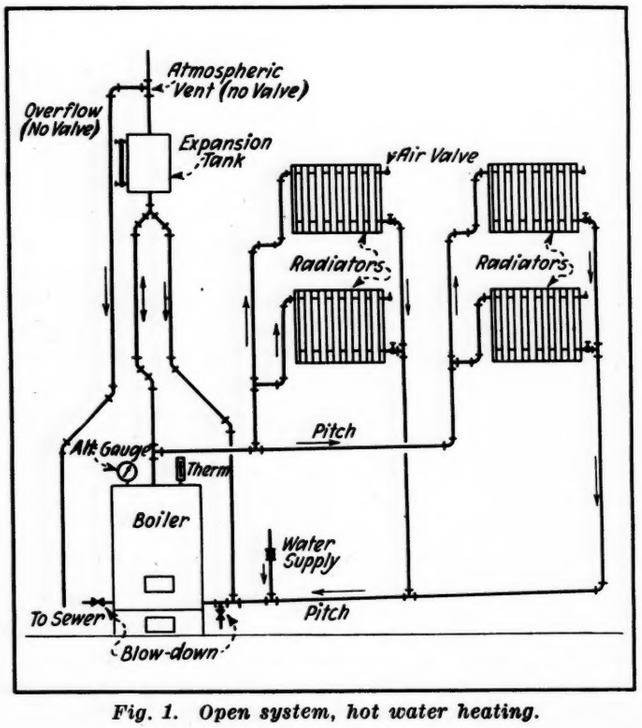


Fig. 1. Open system, hot water heating.

This writing is not intended to imply that hot water boilers are dangerous just because they are of this category, but it does mean to point out that a number of factors need competent attention or danger may result. The brief discussion that follows attempts to illustrate some of the more common defects in the hot water boiler installation, which may invite serious trouble, and it is hoped that some accidents may be prevented by readers.

Hot Water Heating — Open System

Fig. 1 shows a typical hot water boiler installation for building heating. The important feature which distinguishes this heating system from the closed system is the expansion tank which is vented to atmospheric pressure. Then, the normal pressure to which the boiler is subjected is due to the static head of water (feet head $\times$ 0.434 = lb. per sq. in. static pressure).

Probably the biggest hazard with this system is that it may accidentally become a closed system. As the vent on the expansion tank replaces the need of a relief valve on the boiler, free passage to this vent is essential for safety.

The expansion line between the boiler and the expansion tank should never be less than ¾ inch, and it should be of corrosion resistant material. It should be run in as direct a line as possible, and a ¾ inch gate valve drain should be installed at the lowest point in the expansion return, as shown. Horizontal runs or similar natural pockets in which sediment might accumulate should be avoided. Use of smaller than ¾ inch diameter, or of readily corroding piping invites trouble. Rust and sediment may easily pack in the pipe and completely obstruct passage. When this occurs, and a fire is started in the boiler, or the rate of combustion is increased, free expansion is restricted, the boiler pressure goes up, and something is going to happen. Either the obstruction blows free, or an explosion of a pipe or of the boiler results.

Any other cause for accidental conversion to a closed system presents the same danger with this installation. Of course a relief valve can be provided on the boiler, but this is seldom done, as a properly designed and maintained atmospheric expansion system is sufficient protection against over-pressure.

Among the causes of this accidental closing of the system, eight which have been quite commonly encountered by insurance inspectors follow: (1) Restriction of the expansion pipe by rust or sediment. (2) Restriction of the expansion pipe by freezing. (3) Restriction of the expansion pipe by a closed valve. (No

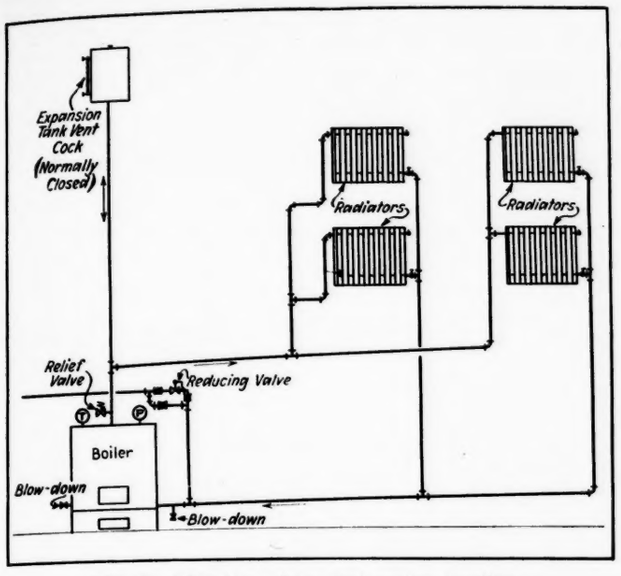


Fig. 2. Closed system, hot water heating.

valve should be installed in this line unless locked or sealed open.) (4) Restriction of the expansion pipe by mechanical injury. Nos. 5, 6, 7, and 8 are identical defects in the vent pipe from the expansion tank to atmosphere. The cures are apparent, and these preventive measures are important.

Damage to the boiler from over pressure may occur in another way. The usual hot water heating boiler is designed for a maximum water pressure of 30 lbs. which will be produced by a static head of 69 feet. In other words, this is the proper limit of elevation for the expansion tank. The elevation is measured by a vertical line from the highest point in the expansion tank or vent line (whichever is the higher) down to the level of the *bottom* of the boiler. A higher head than this may cause overstressing of some part of the boiler and result in damage.

A pressure or altitude gauge, of reputable make, and graduated to at least 45 lbs. or 100 ft. should be provided on the boiler. It is even more important to know the pressure than the temperature.

While explosions do not often result from overheating a hot water boiler, serious damage to the boiler may occur. There are two general causes for overheating; namely, low water, and failure of water to contact the heating surfaces. Methods of preventing low water are obvious, and in flooded systems, such as hot water boilers, the first cause of overheating seldom occurs. A gauge glass should be provided on the expansion tank, and water should be kept in sight in this glass. Its level should be looked at at least once each month.

The second cause, however, is far too common.

Water in a boiler *absorbs the heat* from the metal by contact with the heating surfaces while the fire delivers the heat to the fire side of the surfaces. Failure of the water to contact the metal, as in the case of an interposing layer of scale, grease, or most foreign matters, causes immediate trouble. The coating is usually a heat insulator. As the flow of heat from the fire through the metal to the water is interrupted, the temperature of the metal rises. It soon may be so high that the section affected is distorted, cracked, and permanently ruined.

The boiler should be kept clean inside as well as outside in order to prevent damage by overheating.

Foreign matter should be kept out of the boiler, and natural deposits such as rust should be frequently and periodically removed. A gate valve at least one inch in diameter should be provided at the lowest part on *each side* of the boiler, and they should be opened for a few moments each week of operation. This operation aids greatly in removal of precipitated sediment, which, if neglected, may build up to the fire line and cause overheating, and serious damage. Fuel economy results, too, from clean water surfaces.

Hot Water Heating and Supply — Closed System

The closed system of a hot water boiler installation and the hot water supply boilers usually dispense with an expansion tank or vent. The boiler is supplied under direct pressure from the water supply system. Oftentimes, the incoming pressure exceeds the pressure for which the boiler is built. In these cases, a pressure reducing valve is necessary on the incoming line, and it is set to limit the imposed pressure to the safe limit for the particular boiler.

Fig. 2 shows the closed system type of hot water heating installation, while Fig. 3 shows a typical hot water supply installation.

Over-pressure on the boiler may be caused by expansion of water in the system, or by failure of a reducing valve in the water supply line. The boiler should be protected against over-pressure by installation of a relief valve of reputable make, and set at not over the pressure for which the boiler is constructed.

It is recommended that this relief valve be of a type marked A.S.M.E. standard, and it is important that it be provided with an external lifting or jacking device. This lever should be used to lift the valve from its seat periodically (at least once a month), so as to minimize the possibility of a stuck valve.

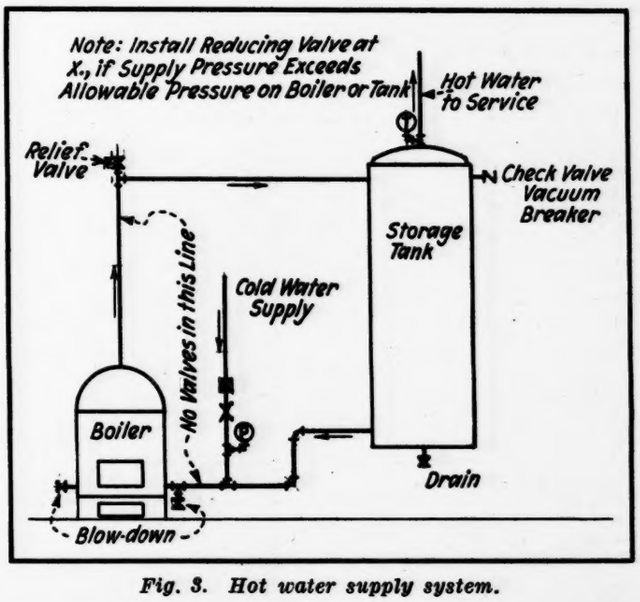


Fig. 3. Hot water supply system.

Pop safety valves as used for steam or air are not satisfactory for water relief due to the blow-back feature.

Many plumbing codes require use of a temperature-pressure relief valve of a type that cannot be practically tested. The writer firmly believes that the system should be protected by a relief valve of the spring loaded type, diaphragm type, or faucet type, and provided with the aforementioned lifting device, even though this supplements the plumbing code valve.

The relief valve escape pipe should always be of corrosion-resisting material and not reduced in size at any point.

Hot Water Boilers — Dangers and Precautions

Sediment removal problems and methods are exactly the same as with the open system heating boiler, and repetition is unnecessary.

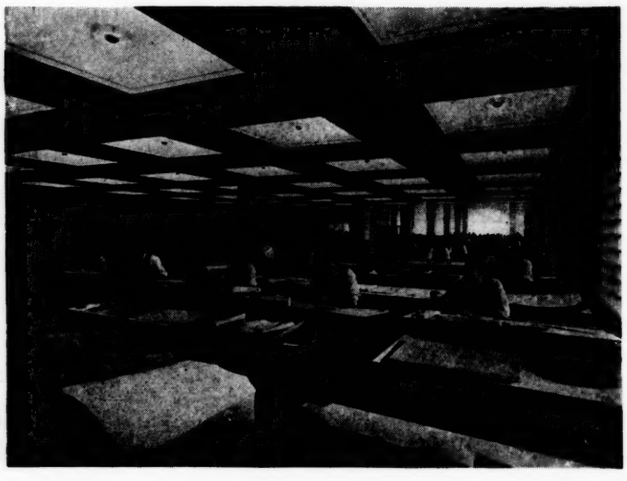
Air Conditioning Boosts Draftsmen's Efficiency 51%

An improvement of 51% in the summer output of drafting room employees is reported by executives of the Detroit Edison Company since moving into their new air conditioned, windowless office and service building.

Because of the radical departures from conventional design, the new building has attracted wide attention from engineers and architects. It is entirely without windows, six stories high, and covers an area 248 by 120 feet. Daylight enters each floor through a band of glass bricks around the building at each floor level. Supplementary light is provided by a special electric lighting system which insures an illumination of 50 foot-candles at the desk top.

Complete air conditioning and high intensity lighting permitted the design of a purely rectangular building, without the *courts* which are traditionally employed to bring a measure of daylight and natural ventilation to working areas. The six-story building contains as much usable space as a conventional eight-story structure without air conditioning, so that the cost of the air conditioning was more than offset by the savings it made possible in construction and maintenance.[1]

Curious to find out what effect the *perfect environment* was having on the office force, executives of the company selected the drafting and surveying bureau as a gauge of efficiency, because that department had adequate time-study records before and after moving into the new building. The amount of time needed for a draftsman to make an average map, or an average number of map changes, had been used to establish an average work unit as a yardstick of a draftsman's progress.



During the summer of 1937, in offices without air conditioning, 8,988 work units required 5,008 man-hours. During the summer of 1938, in the new air conditioned building, 10,474 work units required only 3,872 man-hours—an increase in efficiency of 51.4%.

When this figure appeared to be phenomenal, executives checked up on it by discussing the question with several drafting room employees. One man reported that his actual loss of time during hot, sticky weather was influenced by a great many factors over which he had no control. Starting on a piece of work, he would discover that his elbow had made a smudge on the paper. It had to be erased. Tracing paper would be blown to the floor by the draft from an open window. Paper on the board would get dirty from the same source.

The result of these many small inconveniences and distractions was that the amount of actual time required to finish a given piece of work was greatly increased in a room without air conditioning.

Another draftsman commented on the effect of air conditioning on the tracing of maps. Because tracing cloth is made of a specially-treated cotton fabric, the fibers stretch appreciably under humid conditions. When sections of a large tracing were made on two or three successive days, they would not fit if placed side by side, although they had been made from adjoining parts of the same map. The maintenance of an even humidity, through air conditioning, solved this annoying problem to perfection.

Finally, the complete comfort of workers in the air conditioned drafting room was regarded as a leading factor contributing to greater efficiency of the department.

[1]For a more complete description of this building see article starting on page 13, August, 1938, issue of HEATING & VENTILATING.

Effects of Air Conditions on Farm Products Being Studied by Numerous Agencies

It may be only a few years until there will be wide application of air conditioning of one kind or another for maintaining the best environment for plants, cows, poultry, and other agricultural products. Here is a brief review to indicate that many of the problems along these lines are already past the research stage and await only the actual application.

THE necessity for maintaining certain standard temperatures, relative humidities, and degrees of air cleanliness in connection with industrial processes and for the comfort of human beings has been well publicized over a period of years. Since we come in contact with it less frequently, the importance of temperature, humidity, and even the composition of the atmosphere, in connection with agricultural process is less known. It is well recognized that certain definite temperatures must be maintained in greenhouses for the proper growing of different plants, and it is equally well known that chicken eggs must be maintained at certain temperatures for maximum hatchability. However, the extent to which specialists in horticulture, agronomy, poultry raising and other lines are investigating the subject of atmosphere control in such widely differing fields as storage of dahlia roots, drying of corn, soil temperatures, and flower germination, is hardly realized.

The purpose of this article is to point out a few of the investigations which have been made recently in order to present a quick (but by no means comprehensive) picture of this rapidly changing activity.

Plants

The Bureau of Entymology and Plant Quarantine of the Department of Agriculture is installing air conditioning in its new plant inspection building at Hoboken, where imported plants, seed, and nursery stock will be inspected. Cold storage rooms for storing the plants and bulbs will maintain temperatures from 31 to 41F. The insectory will be arranged that temperature ranges from 60 to 85F can be maintained as desired, with relative humidities from 50 to 80%. Tolerances of 1½F are permitted in temperature and 2½% in relative humidity. A sterilizing room will be provided to produce any temperature from 80 to 150F with relative humidities from 50 to 100%.

An unusual feature of the system is the grille work in the insectory rooms. To prevent the passage of tiny insects from one part of the building to another the grilles are of sheet brass containing 952 holes per square inch.

Tomatoes and Apples: Two investigators at Cornell University have studied fruits and vegetables in order to see if differences in air temperature between the heated and unheated sides of the plant would affect the water distribution through the plant. In the case of tomatoes and apples, when temperature differences of from 9 to 31F were maintained, there was a decided movement of water from the warmer to the cooler side. This was not observed in the case of oranges and potatoes.

Flowers: The relative humidity of the atmosphere markedly affects the transpiration of plants. One investigator found that, using the leaves of purple and yellow coleus as a subject, the water loss from the leaves increased proportionally as the relative humidity decreased over the entire range from 100% to nearly zero. The rate of increase of water loss with decreasing relative humidity was found a constant for each plant. At high humidities the leaves absorb water instead of losing it. The point where transpiration ceases due to high relative humidity of the air is probably the relative humidity of the intercellular spaces of the leaf.

Investigators at the Boyce Thompson Institute in Yonkers, N. Y., using hyacinths, easter lilies and gladiolas as subjects, found that dry weight and flowering were greatly increased in an insulated, artificially heated and lighted greenhouse as compared with an ordinary greenhouse.

In an investigation carried on by the Department of Agriculture, flowers germinated and held in the greenhouse at warm temperatures for a few hours later flowered even when transferred to low temperatures, according to experiments on the effects of short periods of low temperature on flower production of Matthiola.

Plants of the Column Lavender stocks, germinated and held in the greenhouse the temperature of which was maintained at from 70 to 75F and the photoperiod at 17 hr. by supplemental Mazda light (conditions which inhibited flower-bud formation), were transferred for 3, 6, 9, 12, and more days to another room of 17-hr.-day length at 55F temperature. All plants, even the 3-day lots, developed flower buds. In a later test, even 2 days sufficed to induce flower-bud formation. No flowers developed in the control house or in plants given a single day's exposure at from 50F to 55F.

Cucumbers: A great deal of attention has been given to the temperature of air in greenhouses but not too much is known about the effect of varying temperature of the soil surrounding the roots. According to studies made at the Missouri Agriculture Experiment Station, soil temperature has a profound influence on the growth of cucumber plants raised in greenhouses. In the tests the soil was maintained at constant temperatures by suspending crocks in water baths. At 60F

top growth was drastically limited despite favorable air temperatures; at 70 and 85F growth and fruiting were favorable. The moving of plants from 70 or 85F to 60F soil was followed by wilting and fruit injury. Apparently at soil temperatures below 60F and with warm air temperatures, the plants werer unable to secure adequate moisture to offset transpiration, with resulting injury. Such unfavorable conditions to plants may often be expected in greenhouses during the autumn.

Poultry and Eggs

Incubation: Embryonic growth of hens' eggs is greatly stimulated by high temperature and retarded by low temperature, according to studies at Cornell on the influence of temperature on the bio-chemistry and bio-physics of the development of hens' eggs.

Heat effect lessened with the advance of incubation, and after 10 days both high and low temperatures slightly retarded growth. After short (24 hr.) exposures to high or low temperature, even in the early stages of incubation, post-exposure growth was eventually slightly retarded. Temperature extremes, either high or low, caused a greater number of defective and abnormal embryos than a temperature range near the normal. The rate of assimilation of albumen and the disappearance of the free glucose was most rapid at high and slowest at low temperature. Embryonic deaths were reduced during early incubation by slightly high temperature and during the latter part of incubation by slightly low temperature.

The Department of Agriculture has also studied the effect of different incubation temperatures on mortality of chick embryos, using eggs produced by pullets from a cross of leghorn males by cross-bred pullets (Rhode Island red males and Barred Rock females).

A total of 18,665 fertile eggs were incubated at temperatures of 97, 99.75, and 102.5F. Hatchability of fertile eggs at these temperatures was 49.4, 85.3 and 24.3%, respectively. Greatest mortality occurred in the 97 group at morphological stages corresponding to 6-7 and 19-21 days at normal incubation temperatures, while mortality in the 102.5 group was excessive at stages corresponding to 13-15 and 18-21 days of normal development. Observations on malpositions showed a high incidence of head-in-small-end-of-egg at both high and low temperatures and high incidence of head-under-left-wing and head-between-legs at the higher temperatures. The relative survival in inherently weak and inherently strong embryos was not materially influenced by the use of abnormal incubation temperatures.

Chick Growth: High temperatures in the summer retard the growth rate of pullets according to studies conducted at the Missouri Experiment Station, although the smaller chicks are less affected by periods of extreme heat than the older ones. A comparison of the average growth rates of groups of chicks hatched February 2, March 1, March 29, and April 25 showed material differences in the shape of the growth curves depending on the date of hatching and the temperature prevailing during the growing season. The earlier hatched birds grew during the first 20 weeks at a more rapid rate than the later hatched birds.

The California Experiment Station has, over a period of years, done a great deal of work in the study of the effect of environment on development of various farm animals, notably cattle. More recently these studies have been extended to cover chickens, and in one investigation on white leghorn chicks, groups of 5 chicks each were raised from 5 days to a little over 2 weeks of age at controlled environmental temperatures of 61, 64, 70, 95 and 100F.

Three chicks at 61F and two at 64F died, indicating that these temperatures approached the lowest limit of environmental temperature. No deaths occurred at the other temperatures. Food consumption under these conditions decreased approximately in proportion to the increase in environmental temperature. Temperature exerted a pronounced effect on the composition of the body substances gained. Greatest fat storage occurred at 100.4F, while no fat was stored at 64.4F. However, fat storage per gram increase in weight at 60.8F was only slightly lower than that at 95F or 100.4F. Protein gains per gram of body weight were greatest at 60.8F and lowest at 100.4F. The absolute increase in protein in the chick body was lowest at 100.4F, slightly greater at 60.8F, and greatest still at the intermediate temperatures.

Egg Laying: Inasmuch as the body temperature is related to the egg-laying ability of poultry, facts which affect the body temperature of fowls have been investigated by the Department of Agriculture. In experiments conducted in Arizona, it was found that when air temperatures exceeded 86F an appreciable increase in the body temperature of hens taken between 3 and 5 p.m. accompanied further increases in air temperature, increases in body temperature being greater in closely confined hens than in those in open pens. On very hot days the average body temperature between 8 and 10 a.m. tended to decrease as the body temperature between 3 and 5 p.m. increased, and this difference was greater in the closely confined hens. Laying hens tended to have slightly higher average body temperatures than poor or non-laying hens. However, good layers had approximately the same body temperature during laying and non-laying periods. A pronounced daily variation in body temperature of hens was observed, the lowest temperatures occurring about midnight and the highest temperatures at 4 p.m., with the most rapid change occurring between 6 and 8 p.m. Highest body temperatures corresponded with highest air temperatures, but the lowest body temperature did not occur during the coolest hours of the day. The extremes of body temperature recorded for healthy non-brooding hens were from 193.2 to 110.4F.

Turkeys: Incubation conditions and hachability of turkey eggs have been investigated by the Department of Agriculture. Temperatures of 93 and 99.75F gave similar hatchability results but a temperature of 102F markedly reduced hatchability.

Storage

Cream: Temperature has an important effect on the volume changes of fat in cooled cream, according to

studies conducted at Cornell University. Workers there found that at zero, 41 and 50F the maximum concentration of fat in cooled cream occurred in about four hours, while at 59 and 68F the contraction of the fat was more gradual, in some instances continuing over a period of months. At 32 and 41F, after the maximum contraction of the fat was reached, a gradual expansion occurred for two months or more, probably due to a phase adjustment following the initial rapid crystallization of the fat. This rapid adjustment of the physical state of the fat globules at low temperatures greatly influenced the viscosity, creaming, surface tension, and foaming.

Butter: Studies on the packing and storage of butter have been extensively conducted in New Zealand. A research worker there reports that butter stored at 32F showed only a slight loss in quality at the end of fourteen weeks but that there was a marked deterioration in quality after twenty-one weeks storage at this temperature as compared with butter in frozen storage. This same investigator also found that butter held at relatively high temperatures in the factory cool room or during transit was found to be particularly susceptible to the development of surface taints.

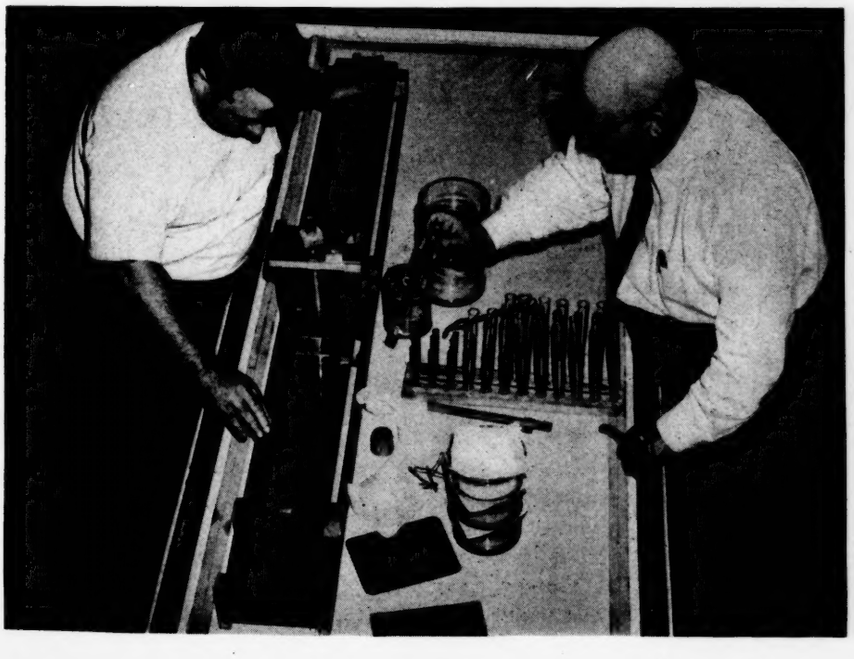
Potatoes: The Department of Agriculture has studied the design and operation of potato storages for regions where the average winter temperature is below 20F.

It was found that temperature and moisture control in northern potato storages mainly by conduction of heat and condensation of moisture upon waterproofed surfaces is better than control mainly by ventilation. This is because better control is secured which results in reduced potato shrinkage, control is partly automatic so requires less attention of the storage operator, less artificial heat is required, and condensation of moisture within the storage adds very little to conduction loss, but about 1000 B.t.u. of heat is lost with each pound of moisture removed by ventilation in addition to conduction loss.

Temperature and moisture control by condensation would not seem applicable to the southern area where conduction losses are low and emphasis must be placed upon the removal of heat. No sharp division line can be drawn between the northern and the southern area but in areas where the average winter temperature is 20F there will probably be little difference which system of storage control is used.

Studies are also reported from the Maine Experiment Station to determine the most satisfactory storage conditions for potatoes in the colder regions of the United States and to develop durable structures in which desirable storage conditions can be maintained with a minimum of attention. An effort also was made to develop a system of handling potatoes in the houses to decrease labor requirements and reduce injury to the potatoes.

It was found that potatoes stored at 40F and at a uniform relative humidity have a uniform rate of shrinkage between the thirtieth and the two hundred and tenth day, which is about half the rate for the first 30 days. Holding potatoes for the first two weeks of storage at temperatures of from 56 to 60F decreases shrinkage to about 20% below average, while holding during the early period between 40 and 46F increases shrinkage to 20% above average. Within the range of temperature and humidities studied potato shrinkage increases uniformly with increases in saturation deficit. Condensation of moisture in the wall-circulation space has been an unrecognized factor in the control of storage conditions and a recognized factor in building depreciation. Such condensation tends to make storage temperatures uniform and removes moisture from the air automatically, and if waterproof wall-circulation surfaces are provided will not increase the building depreciation rate. Walls and ceilings having high insulation resistance permit the carrying of high relative humidities, while high relative humidities cannot be carried where wall and ceiling insulation resistance is low. Day ventilation (warmer outside air) tends to remove more moisture for a given amount of heat, so



Studying action of test insects, where air conditioning assures an abundance of test insects at all times.

is desirable in the winter when there is little heat to spare. Night ventilation (colder outside air) tends to remove less moisture for a given amount of heat, so is desirable for fall or spring ventilation when potatoes must be cooled by ventilation. Limiting wall-insulating values are reached when the necessity of removing surplus heat by ventilation results in lower humidities than would be obtained with a lower insulating value.

Sweet Potatoes: The Department of Agriculture has studied about 40 varieties of sweet potatoes in order to determine their suitability for drying well. The department developed methods for drying sweet potatoes in slices or strips which may later be prepared as baked, candied, creamed, sauteed or French fried or as pie filler. The potatoes were peeled by an abrasive machine, washed, trimmed, sliced, steamed and then dried at from 130 to 165F until the residual moisture was from 12 to 15%. The material so prepared is not hygroscopic and can be stored for long periods provided it is protected from weevils and beetles, to which it is highly attractive.

Melons: Too low or too high temperatures in storage are bad for honeydew melons, according to studies by the Department of Agriculture.

The results of five storage tests indicated that honeydew melons, but not cantaloups, are subject to a low temperature break-down occurring after 2 weeks' storage at 32 and 34F, and to a lesser extent at somewhat higher temperatures. Neither type of melon stored well above 40 and 42F because of the rapid development of decay. A more detailed study was made of melons stored at 32-34F, 36-38F, and 40-42F (with 38-40F in a few tests), comprising eight tests with honeydew melons and six tests with cantaloups (63 crates). Again, low-temperature break-down occurred in the former but not in the latter, developing most abundantly at 32-34F, to some extent at 36-38F, but not at all at 38-40F or 40-42F.

The results of the storage tests indicated that cantaloups removed from refrigerator cars can be held for a week or slightly longer at 32-34F, while honeydew melons can be safely held for 2 weeks or longer at 32-34F or 36-38F, and with certain lots longer storage may be practicable. With both types of melons the riper ones decayed more readily in storage.

Dahlias: Cornell University has studied the effects of temperature and humidity requirements on the storage of dahlia roots.

With relative humidity maintained at 75%, there was no striking difference in the loss of weight of stored tubers within the range of 35 to 65F. At 65F there was a tendency to sprout, and at 35F the roots were slow in sprouting after planting, leading to the suggestion that the ideal temperature range for storing dahlias is probably between 40 and 45F, with the optimum relative humidity between 80 and 85%.

Apples: Control of gases in the atmosphere is coming in for more intensive study in connection with plant growing these days. One investigator reports that core flush, a storage trouble definitely associated with low temperature in the case of the McIntosh apple, was avoided by the use of a temperature of 39F and a modified atmosphere of 7% carbon dioxide, 14% oxygen, and 79% nitrogen. Varieties differed in their optimum concentrations, and even in a single variety the favorable concentration varied with the temperature and with the maturity of the stored fruits. The results indicated that for the attainment of maximum quality in gas-stored McIntosh apples well-colored, well-matured fruit should be used.

A relationship between high temperatures in late autumn (particularly October) and poor keeping of apples in air cooled storage was found by experimenters at the Michigan Experiment Station.

Eggs: Two important variables affecting the quality of eggs kept in cold storage are time and temperature. The Washington Experiment Station studied the effect of these variables on the quality of eggs using eggs from white leghorn pullets and measuring the albumen index both before and after storage. Seven lots of eggs were stored at temperatures of 30, 50, 70 and 90F, each lot having eggs of high, medium and low initial albumen index. The time the eggs remained in storage varied from 3 to 192 days.

The eggs of varying initial quality stood up under storage conditions in proportion to their original score, the percentage loss being approximately the same for each group. At 30F storage temperature eggs lost about 30% in albumen score in 48 days, and about 44% in 192 days. At 50F, 70F, and 90F loss in score occurred at increasingly rapid rates, those at 70F and 90F declining 71.7% in albumen index in 32 days and 8 days, respectively.

Cotton: As a result of five years test at the Department of Agriculture cotton ginning laboratories, it has been concluded that seed cotton can be dried effectively and economically by introducing heated air either into the suction line entering an over-head air-line or into an over-head out-of-the-air cleaner.

Onions: Storage temperatures have a great deal to do with the marketability of onion bulbs and on subsequent seedstalk development, according to research at Cornell University. The largest percentage of seedstalks and the lowest marketable yields were produced by sets stored at 40 and 50F. A storage temperature of 30 to 32F was most favorable and temperatures from 60 to 70F were not satisfactory because of growth and shriveling in storage.

Both temperature and length of day were evidently concerned in bulb formation in the onion. No bulbing occurred during the winter or early spring at any of three ranges of temperature used, namely, from 50 to 60F, 60 to 70F, 70 to 80F. With a 15-hr.-day and a temperature of from 50 to 60F no bulbing occurred, but when the temperature was raised to from 60 to 70F or 80F bulb formation took place.

Corn: Velocities and temperatures of air passing through a corn dryer have a great effect on the quality of corn which can be dried, according to research reported from the Oregon Experiment Station and covering the general subject of corn grind.

An analysis of data from 36 tests with the continu-

ous-process shelled-corn drier indicates that three variables materially affect the moisture differential across the column. These variables are (1) the thickness of the corn column, (2) the temperature of the air entering the dryer, and (3) the air velocity through the corn column. The slower the air velocity through the column at any given drying temperature and column thickness the greater will be the moisture differential across the column. A comparison of two groups of tests made when using a 4-in. column of corn demonstrated the effect of air velocity. The average temperature of the series of tests was 170F. An increase of the air velocity from 88.4 to 106.5 f.p.m. per sq. ft. of column area, which amounted to a 20% increase, decreased the moisture differential across the column by 41%, which was 12% less than the previous moisture differential. A static pressure of 0.7 in. of water is required to produce an air flow of 90 cu. ft. of air per minute through a square foot of corn column. The total static pressure which the fan must operate against will be approximately 1 in. of water, as a pressure of from 0.2 to 0.3 in. of water will be required to force the air around the furnace through the duct system.

The two most important factors affecting the quantity of corn which can be dried in a shelled-corn drier are first the temperature of the drying air, and second the velocity of the drying air in the column. The air temperature should be kept as high as practicable in order to get the maximum output from any given size of drier. A temperature of from 170F to 180F is recommended. To keep the moisture differential across the column of corn at 4% or below requires that an air volume of approximately 90 cu. ft. per minute be maintained through each square foot of corn column. At this velocity through the corn column the exhaust air retains considerable drying capacity and requires a relatively small amount of heat to bring it up to the operating temperature of the drier. The amount of heat required to dry 1 ton of shelled corn from 30% moisture content to 12% moisture content in a continuous-process drier was found to be approximately 1,334,000 B.t.u. The power cost for driving the fan, operating the grain-removing mechanism, and elevating the grain into the drier was approximately 40 cents per ton at an electrical rate of 3 cents per kilowatt hour.

Insects

Locusts: Studies have been made in India on the influence of constant and alternating temperatures on the development of locusts. A study of the eggs of this insect at 100% relative humidity and constant temperatures ranging from 68 to 98.6F, the threshold of development was found to be 62.6F and the optimum range of development between 91.4F and 98.6F.

Domestic Pests: Cockroaches, mosquitoes, carpet beetles, clothes moths, and bugs that farmers and housewives would like to eradicate are the subject of study by the New Jersey State experiment station at Rutgers. The purpose of this research, carried on in air conditioned laboratories, is the study of problems of insect control throughout the year. The air conditioning assures an abundance of test insects at all times without regard to the natural breeding cycle in natural weather conditions.

A temperature of 72F is maintained during the winter and 75F during the summer months. The average relative humidity of 73% is just right for roaches and beetles.

Milwaukee Air Conditioning Systems Hit By Warm City Water

In August, the *Milwaukee Journal* carried a story which brought to light a controversy between the owners of air conditioning systems and the city water department. According to the story, numerous air conditioning systems using city water were rendered practically useless by high city water temperatures and the blame was placed on the filtering unit at the city water works. The cooling system owners claimed that during the filtering process the temperature of the water was raised to such an extent that it was useless for cooling.

Henry P. Bohmann, superintendent of the city water works, vigorously denied that the filtering system had an appreciable effect on the temperature of the water. He supported his contention by offering figures showing a wide variation in the temperature of the water stating that, "When the wind stays in the same direction for several days the temperature varies little. When the wind shifts it can change quickly. Passing through the filtration plant does not alter the water temperature." Bohmann gave these figures on maximum water temperatures last summer before the filtration plant was in operation.

May	50F	August	58F
June	59F	September	67F
July	63F	October	63F

Supporting Bohmann, a widely known air conditioning engineer said that a west wind blows the warm surface water toward the Michigan side of the lake. East and southeast winds have prevailed on several of the days previous to the complaints.

The air conditioning installations in Milwaukee are of three general types, about 70% depending upon city water and the others on private deep wells or mechanical refrigeration.

Charles H. Randolph, air conditioning engineer of the Wisconsin Electric Power Co., said that many complaints had been received from places that used city water but none from places where the water supply is from deep wells. The temperature of the water from deep wells remains fairly constant throughout the year, from 53 to 58F.

Mr. Randolph said that since July 29, city water has been ranging from 63 to 68F. He said that when water goes above 68F it is practically useless for cooling.

ABSTRACTS of Current Papers, Books and Pamphlets

Patent Fundamentals

This is a textbook for inventors, executives, and students which explains in non-technical language and demonstrates by practical examples the underlying principles of true invention, procedure in obtaining patent protection, drafting effective claims, making assignments, issuing licenses, and, in brief, how to protect both invention and inventor.

Many inventors have failed because they did not receive the patent protection warranted by their inventions. The best and most approved ways of defining and protecting an invention are illustrated by numerous practical examples and thorough discussions of many important court decisions. By studying this material, the inventor or student should become a fair judge of patent claims. Engineers of all kinds, chemists, and executives interested in inventions will find the information required for cooperating intelligently with patent attorneys in preparing and prosecuting patent applications. The chemist's problem is discussed, and there is an analysis of decisions relating to chemical patents.

Many executives are called upon to make important decisions relating to patent matters. Questions arise concerning the interpretation of the scope of a patent, the validity, and possible infringement. Attorneys-at-law, who are often consulted in a preliminary way in patent matters, will find much desired information on questions of patentability, the preparation of assignments and license contracts, and the most important issues in infringement suits.

This treatise includes information on trade-marks and copyrights, design patents, prints and labels, and illustrates the different conditions under which these protective measures become available. It is written in textbook style, and is adapted for use in educational institutions having courses dealing with the fundamentals of patent law.

[*"Patent Fundamentals," by Adelbert Schapp. Published by The Industrial Press, 148 Lafayette St., New York. Cloth bound; 5½ x 8½ in.; 176 pages; price, $2.*]

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Film Preservation

As photographic film has become an important documentary material, a systematic study of it was undertaken by the National Bureau of Standards as a part of its general research on problems relating to the preservation of records. This summary was prepared in order to have the more important information developed available in one publication.

The films tested were of two types, one coated with a photographic emulsion and the other having a light-sensitive dye incorporated in the base for forming the image. The sheetings comprising the bases are, for the first type, nitrate and acetate, and for the second, viscose and acetate.

Both types of acetate film were found to be very stable and are considered suitable for permanent records. The nitrate film is of little value for record purposes because of its inflammability and instability. The viscose film was in an intermediate position and appears to be suitable for records requiring moderate longevity.

In large repositories, the precautions found desirable to minimize the damage to stored records contained on paper should be observed for films. An air-conditioning system should be used by means of which the temperature and the humidity of the air can be maintained uniformly, and positive circulation of air through the storage spaces effected. The air should be cleansed of acidic gases by washing it with an alkaline solution, and it should be filtered to remove dust. The use of nondusting materials of construction, such as tile or certain plastic products, and frequent dusting with vacuum appliances are helpful.

The atmospheric conditions recommended for storage of records contained on paper are a relative humidity of about 50%, a temperature of 70F to 80F, and air cleansed of acidic gases and dust.

[*"Summary Report of Research at the National Bureau of Standards on the Stability and Preservation of Records on Photographic Film," by B. W. Scribner. National Bureau of Standards Miscellaneous Publication M162. Published by the National Bureau of Standards, United States Department of Commerce. Paper cover; 6 x 9 in; 17 pages. For sale by the Superintendent of Documents, Washington, D. C. Price, 10 cents.*]

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Stoker Handbook

Domestic and small commercial stokers have become widely accepted by the general public during the past few years. During this period there has been a scarcity of practical information outside of the manufacturers service books on the installation and servicing of different types of equipment. Because of this, this stoker handbook should find rapid acceptance among men interested in stoker installation and servicing.

The book can be divided into eight main classifications dealing with details of construction of stokers; characteristics of coal; combustion; types of heating systems; predicting coal consumption; sizing stokers; installation; and care and operation of stokers. While the chapters are short and some of the material difficult to locate, sufficient information is included to meet the needs of most service and installation men. Particularly good are the sections on installation and operation and the care of stokers.

[*"Stoker Handbook," by H. D. Airesman. Published by J. B. Lippincott & Co., Philadelphia, Pa. Semi-flexible binding; 6 x 9 in.; 201 pages; price, $3.*]

Climate and Health

Persons who have made a study of the influence of climate and weather on the health of man agree that both climate and weather seem to exert a tremendous influence on human welfare and existence. Positive scientific proof is difficult to secure because of the many other factors which tend to confuse the picture. In an effort to clarify this situation and to paint a picture of the environmental dominance over man, this book has been prepared. In writing the book, the author—Dr. Clarence A. Mills—has gone through the great mass of literature dealing with the subject and has selected only pertinent material possessing practical value for those who wish to know the effects of climatic environments in matters concerned with human health and disease.

While the entire book will be of interest to air conditioning men, certain sections are more important than others as, for example, the chapters dealing with the therapeutic uses of natural and artificial climates; the conditioning of indoor environments; and the susceptibility to heat effects.

In the chapters on air conditioning of indoor environments the author points out some improvements which could be incorporated in air conditioned spaces. He shows, for example, that a better control of the radiant heat loss of the body would considerably improve comfort conditions within rooms both in winter and summer. Most present-day radiant heating systems attempt to do this but fail, according to Dr. Mills, mainly because the radiant heat is quickly absorbed by wall materials and eventually results in warmed air the same as with the more common heating systems. Real success will come, states Dr. Mills, only when heat-reflective wall and ceiling surfaces are provided so that the radiant heat introduced in a room will remain in radiant form, vibrating from wall to wall with the speed of light. By applying wall coverings faced with aluminum foil or similar heat-reflective material, one may then easily introduce into a room radiant heat that will not be transformed into kinetic heat of warmed walls or air. The clothing or skin of a person in the room, however, will readily absorb the heat rays and become warm.

In the author's laboratory, rooms have been constructed to test out and demonstrate these principles of radiant heat use. One of the rooms, with air conditions at a level of 89 to 92F and 60 to 70% relative humidity, has all of its inner surfaces lined with aluminum foil and is equipped with cooled plates for radiant heat absorption. Here, in spite of the high air temperature and humidity, animal growth proceeds fully as well as in 65F air, and the room is quite comfortable for occupancy by people adapted to winter weather.

In a second foil-lined room, provision is made for lowering air temperatures as far as 32F and for radiant heat input from electric coil heaters. In this room a person can be quite comfortable in shirt sleeves below 40F, and such comfort is delightful, for one has body warmth with cold air to breathe. The foil-covered walls efficiently reflect the radiant heat directed into the room so that it reaches the occupant from all sides, even though the foil surfaces keep themselves approximately at air temperature.

Skin, clothing, wood and iron surfaces in these rooms show very different behavior towards radiant heat than to the reflective surfaces. Such materials in the hot air give up their heat very readily to the cold plates and quickly drop far below room temperatures. On entering the hot room, one is quickly aware of this cooling of the clothing. In the cold room, on the other hand, the radiant heat input is rapidly absorbed by the skin and clothing, the temperature of the latter quickly rising above that of the cold air.

Dr. Mills states that this method of conditioning has very obvious advantages over present air conditioning methods. First, the heating or cooling load will be very much less than that of present methods, for only the room inhabitants and furnishings will be conditioned, and not the entire air and building mass. Second, the need for expensive insulation will largely be obviated, for the wall surface temperatures will no longer be of importance either in winter or in summer. Third, disagreeable and harmful sharp contrasts in outside and inside air temperatures will not be necessary. Fourth, the much smaller heating load for winter and cooling load for summer will bring year-round conditioning into the gas or electric field of fuel source and largely do away with the residential heating plant. Fifth, the short lag in making a previously unconditioned room comfortable will mean that the room need be conditioned only while it is actually occupied, being in this respect somewhat similar to room lighting.

A list of some of the other chapters which are of interest to air conditioning men includes: Climatic Dominance over Growth and Development; World Climates as they Directly Affect Man; Susceptibility to Heat Effects; Therapeutic Uses of Natural and Artificial Climates; and Tides in Sickness and Death Rates.

[*"Medical Climatology," by Clarence A. Mills. Published by Charles C. Thomas, Springfield, Ill. Cloth cover; 6 x 9 in.; 296 pages; price, $4.50, postpaid.*]

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Smoke Prevention

Each year the Smoke Prevention Association publishes a manual of ordinances and requirements in the interest of air pollution, smoke elimination and fuel combustion. The purpose of the manual is to supply information on these subjects for municipalities seeking the establishment of anti-smoke ordinances; architects; boiler, stoker and smoke eliminating device manufacturers; engineers; contractors; chimney builders; railroad and marine interests.

In this 1939 edition there is included all of the papers read at the recent convention of the Smoke Prevention Association at Milwaukee. Included are articles on instructions in burning fuels smokelessly and economically; requirements that should be incorporated in a smoke ordinance; properties of coal that affect burning characteristics; use of the Ringleman chart in measuring smoke; and current developments in reducing fly-ash emission from chimneys. Besides these there are approximately 110 pages devoted to such subjects as a model smoke abatement ordinance; methods used to determine smoke density; uniform stoker rating;

operation of underfeed stokers; description of methods of measuring air pollution; equipment and procedure of dust fall determination; instructions for burning low volatile coal in fire box type of heating boilers; and instructions for firing bituminous coal.

[*"Manual of Ordinances and Requirements." Published under the auspices of the Smoke Prevention Association, 139 N. Clark St., Chicago, Ill. Paper cover; 6 x 9 in.; 172 pages; price, 50 cents.*]

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Steam and Hot Water Fittings

The feature of this book is its practical treatment of the subject of steam and hot water fitting. Since it was written to appeal to the students, steamfitters, and designers, this feature should prove of considerable value. The book is unusual in that it describes certain manufacturers' materials and products. While the author does not claim that these are the best he does state that the materials mentioned, the systems described and the tables given have been used in thousands of installations and where correctly installed have given satisfaction to both the owner and contractor for many years.

A list of the subjects discussed include boilers; steam radiators and coils; steam heating systems; vapor heating, vacuum systems; pumps; pipe and fittings; valves; unit heaters; pipe fitting tools; greenhouse heating; hot water heating systems; and panel heating. A large number of diagrams showing how the equipment is hooked up are presented as well as information on the design of systems and pipe sizes.

[*"Steam and Hot Water Fitting," by William T. Walters. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Cloth bound; 6 x 9 in.; 184 pages; price, $2.*]

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BRIEF REVIEWS

COAL. A review of bituminous coal in 1938 and final statistics for 1937 on bituminous coal. This is a chapter from the Minerals Yearbook 1939. [*"Bituminous Coal," by M. E. McMillan, R. L. Anderson, L. N. Plein, F. G. Tryon and J. W. McBride. Published by the Bureau of Mines, United States Department of Interior. Paper cover; 6 x 9 in.; 167 pages; price, 10 cents. Available from the Superintendent of Documents, Washington, D. C.*]

AIR-RAID SHELTERS. A report of tests carried out on air-raid protection shelters which were built for J. & E. Hall, Ltd., of England, for the shelter of their factory workers. Gives details of steel and concrete shelters, data on carbon dioxide concentration and temperature and humidity maintenance, physiological data on effects of lack of oxygen and excessive carbon dioxide, as well as information on pulse and respiratory rates and discomfort felt in various types of shelter. [*"Report on Occupancy Tests of Air-Raid Shelters for Factory Workers." Published by H. K. Lewis & Co., Ltd., 136 Gower St., W. C. 1, London, England. Paper cover; 8 x 10 in.; 27 pages and 3 charts; price, 2 shillings, approximately 50 cents.*]

DRAFT HOODS. A discussion of the fundamentals of gas appliance draft hood design. Includes data on the results of tests on many types of draft hoods and presents information as to the design of the most efficient type. Tests were conducted on a small domestic steam boiler. [*"Some Fundamentals of Draft Hood Design," by L. C. Price. Bulletin No. 15, Engineering Experiment Station, University of Arkansas, Fayetteville, Ark. Paper cover; 6 x 9 in.; 62 pages; single copies available on request.*]

ESTIMATING FUMES IN AIR. Some time ago the translation of the first edition of this book was reviewed in HEATING & VENTILATING. The present edition is published in Russian and gives in more detail analytical methods for gas determinations and each chapter has a bibliography of both Russian and foreign literature. The book is designed for use for industrial physicians, sanitary engineers and chemists. [*"Methods of Determining Toxic Gases and Vapors in Air," by A. S. Zhitkova. Published by the Government Publishers for Industry of Defense, Moscow, U.S.S.R. Cloth bound; 183 pages; price, 7 rubles, 50 kopecs.*]

AIR COOLING. Descriptions of the methods of cooling now in use in Arizona homes. Contains information on human comfort, length of the Arizona cooling season; types of cooling systems including night cooling, direct evaporative coolers, indirect evaporative coolers, well water coolers and mechanical refrigeration. Also gives a complete discussion of the direct evaporation cooler, its history, theory, construction, installation and operation. [*"Cooling for the Arizona Home," by Martin L. Thornburg and Paul M. Thornburg. Published by the Agricultural Extension Service, College of Agriculture, University of Arizona, Tucson, Ariz. Extension Circular No. 105. Paper cover, 6 x 9 in.; 31 pages.*]

HAZARDS OF COMBUSTIBLE ANESTHETICS. A discussion of the explosion hazards of combustible gases and vapors used as anesthetics and of the means useful for the elimination or mitigation of the explosion hazards. [*"Explosion and Fire Hazards of Combustible Anesthetics" R. I. 3443, by G. W. Jones. Published by the Bureau of Mines, United States Department of the Interior. Paper cover; 8½ x 11 in.; mimeographed; 17 pages. Available from the Bureau of Mines, Washington, D. C., on request.*]

AIR CONDITIONING. A statistical review of all installations reported by 141 utility companies. Reports are broken down into the various applications in residential, commercial and industrial fields. Records obtained are as of March 31, 1939. For further details see the report on page 62. [*"Air Conditioning Installations." Published by the Air Conditioning Committee, Edison Electric Institute, 420 Lexington Ave., New York. Paper cover; mimeographed; 8½ x 11 in.; price, $1.*]

AIR CONDITIONING. Designed to be a complete course in air conditioning. Made up of about half text and half manufacturers catalogs. [*"Complete Course in Air Conditioning, Heating and Ventilating," by M. N. Beitman. Published by Supreme Publications, 3727 W. 13th St., Chicago, Ill. Paper cover; 8½ x 11 in.; approximately 130 pages; price, $1.*]

EDITORIALS

Job Training

Probably no phase of the whole subject of heating and air conditioning is in a more confused state than that of training men.

Most surprising is the common failure to understand fully that our modern method of vocational training in which organized schools take part is essentially a two-part or two-stage process. In this process a part of the training is accomplished at school while the other part is accomplished on the job. What may lead to some of the confusion of thought is that while the training at the school is usually formal, systematic, organized, and recognized as training by both teacher and student, the same does not always apply to the second stage. In the second stage the training may be entirely unsystematic, may be nothing more than learning by experience but it is training just the same and usually a man is not ready to take his place as a self-sustaining member of the industry until he has passed through both stages. This modern method differs from the older methods of training apprentices on the job only in so far as it is more carefully organized and in so far as class-room methods have displaced other forms of instruction.

While the failure to recognize this situation is common, still there are those who have recognized it rather fully. Generally these are the ones who have taken steps to meet the situation, who have organized—or at least systematized—ways of co-ordinating the school with the job, who have analyzed their job requirements and who have moved to secure definite programs of training. Generally, too, they have been among the profit-making firms in the industry. It is significant that they are not necessarily the large operators or the big corporations.

A lot of the confusion which has attended training of men for this industry, a lot of the distrust of the newly organized schools, a lot of the grumbling over poor personnel, much of the present confusion over the ability of the industry to employ trained men, many of the protests of trained students over their inability to find employment, and much of the ballyhoo over how badly men are needed in this industry would be greatly helped by a clearer understanding of how training is related to ability to earn a living.

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Disaster Insurance

Reports of the disaster in the nursing room of a New Jersey hospital where four infants lost their lives when a taped-on valve let go during the night should serve as a reminder of how desirable it is to keep even small accessories in good repair. Adhesive tape makes a poor substitute for metal threads. We all know this, but it seems to take a major disaster to bring out in strong relief the risk involved in continuing to use worn-out and obsolete equipment. Some of the responsibility for this must rest on our shoulders for failing to get owners to understand that replacements can pay big dividends both in reduced expenses as well as in providing insurance against disaster.

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Fire Regulations for Air Conditioning

In Detroit, as a result of experiences with fires and the smoke resulting from them, regulations have been drawn up setting up requirements for installations of fire dampers in air conditioning ducts, which regulations go beyond any other known requirements in this particular. The point has been made that these regulations would result in an increased cost to the owner in order to get a duct-distribution air conditioning system installed in Detroit. While surely no one would want to increase the installation costs deliberately a good case can be made for at least the thought behind the requirements. There is no reason why any air conditioning installation should be so constructed that it results in a greater fire or smoke risk than if the building were erected without such a system in it. Whatever may be necessary to keep the risks at this level would be justified regardless of a small extra cost.

There is another angle to such regulations. Virtually all of them are restrictive and forbid the doing of certain things. It would seem at first thought that they necessarily fix limitations which can not help but restrict the field of action. This is not necessarily true. The restrictions apply to certain situations only and to certain methods. They do not make it impossible to use other methods or equipment nor do they prevent the invention or development of new methods or equipment. For example, it would appear that a strictly central air conditioning installation in a multi-story building would be at a disadvantage because of the large number of fire dampers required. The fire damper requirement would not be so severe if a central conditioner were located on each floor without ducts passing from floor to floor. If ducts were done away with entirely then any requirements regarding duct fire dampers would disappear entirely. Such an arrangement would be possible by passing entirely to individual room units and could be carried even farther if self-contained cooling units were adopted. Thus there is still much scope left in which to find economical applications using present methods and equipment. It is also possible that if drastic fire regulations should go so far as to rule out central systems with ducts in multi-story buildings, then increasing attention would be paid to the development of small central units and larger self-contained units with the final result that costs to the owner might even be decreased.

We believe that the whole question of fire hazards and the Detroit regulations in particular should be faced dispassionately. Keep in mind that while regulations may be restrictive in some directions there are cases on record where much good has resulted from what seemed highly restrictive measures.

NEWS OF THE MONTH

Warm Temperatures in 1938 Reduced Fuel Consumption, Bureau of Mines Reports; Gas Heat Increases

PITTSBURGH — Higher temperatures during the calendar year 1938 as compared with 1937 resulted in a decrease in the quantities of various fuels used in the heating of buildings, according to a tabulation made by the Bureau of Mines. Declines in fuel use in 1938 as compared with 1937 for building heating were shown by anthracite and all types of coke (except petroleum coke), briquets, lignite, and natural gas. Increases, however, were shown by range oil, fuel oil, liquefied petroleum gases, petroleum coke, and a slight gain was shown by manufactured gas. Estimated figures on fuel consumption for building heating for the years 1935-38, inclusive, and 1924 are shown in the accompanying table.

Wherever available the figures represent the quantities of fuel actually consumed for domestic heating or for heating houses, apartments, institutions, and so on. Where such figures are not available, but where the fuel is known to be used chiefly for domestic purposes, the total production figures are shown to indicate the trend of growth.

In interpreting the table, the following points should be noticed: anthracite buckwheat is not all used for domestic heating but a considerable part is. The imports of anthracite are chiefly from the United Kingdom and U.S.S.R. Figures on fuel briquets are calculated and the figures given are production plus imports less exports, where available. No data are available on package fuel production in 1924 as there was probably little, if any. The 1938 figures for by-product coke sales are subject to revision as are the 1938 figures for anthracite, other than Pennsylvania anthracite, lignite, range oil, fuel oil, and natural gas. The figures on gas-house coke sales are partly estimated and it is believed that about two-thirds of the lignite production (which is shown) is used for domestic purposes. The figures on range oil cover the light distillates which are used for hot water heating and cooking, as well as for house heating. The figures for fuel oil listed under domestic heating and commercial heating include all grades of fuel oil for building heating. The figures for natural gas are those for both domestic and commercial use.

TRENDS OF FUEL CONSUMPTION FOR BUILDING HEATING*
(ABSTRACTED FROM DATA PUBLISHED BY THE BUREAU OF MINES)

FUEL	1924	1935	1936	1937	1938
SOLID FUELS, THOUSANDS OF TONS					
Anthracite:					
Pa. domestic	56,576	29,654	30,473	29,093	26,207
Pa. buckwheat No. 1	9,511	7,212	7,508	6,860	6,159
U. S. other than Pa.	705	423	520	469	369
Imports	118	571	615	396	363
Packaged fuel	—	25	66	146	161
Coke:					
Byproduct	2,813	9,162	9,644	7,808	7,100
Beehive	140	264	378	300	93
Imports	83	317	330	286	135
Gas-house	1,400	466	404	351	342
Petroleum	761	1,458	1,378	1,307	1,602
Briquets	581	877	1,114	977	868
Lignite	2,255	2,750	3,110	3,218	3,008
Bituminous	(†)	(†)	(†)	(†)	(†)
OIL, THOUSANDS OF 42 GAL. BARRELS					
Range oil	—	21,526	27,292	32,580	36,000
Domestic heating, Commercial heating	5,021	76,853	99,257	116,583	118,000
Liq. petr. gases, dom.	—	509	715	972	1,377
GAS, BILLION CUBIC FEET					
Natural	285	414	455	489	476
Manufactured	—	35	41	46	48

*See accompanying text for notes, exceptions, and explanations.
†Exact data are not available; estimated to be between 55 million and 77 million tons, including lignite and anthracite and semi-anthracite outside of Pennsylvania, which are shown separately.

Canadian Code to be Distributed

TORONTO—The standard heating code approved by the Ontario chapter of the ASHVE for steam and hot water is to be made available to members of the trade and municipalities who may desire to adopt it.

Air Hygiene Sponsors Meeting on Industrial Air Conditions

PITTSBURGH — The fourth annual meeting of Air Hygiene Foundation, geared to show that "healthy workers make for healthy business," will be held at Mellon Institute here November 14-15. Dr. H. B. Meller, managing director, announces that the amount of information available forces expansion of the program from a one-day to a two-day session this year. He warns that stepped up production will intensify industrial health needs.

Reports on the Foundation's medical and engineering research, including latest advances in employee health protection, and reports on the impact of health on employer-employee relations, will be made to representatives of the 200 industrial concerns affiliated with the Foundation.

Andrew Fletcher, of New York, vice-president of St. Joseph Lead Company, will point to specific dollar-and-cents savings resulting from proper health precautions, showing that aside from all the other factors "good health is good business."

A forum is planned to show that "Industrial Health Pays Double Dividends" in economic savings, and improvement in labor relations and public good will. V. P. Ahearn, of Washington, executive secretary of the National Industrial Sand Association, will preside.

Robert J. Watt of the A F of L, and representative of the U. S. Labor Department at the International Labor Office, Geneva, is scheduled to speak on labor's interest in occupational disease prevention.

The technical program includes: Reports on the Foundation's engineering research at Harvard, by Philip Drinker, chairman of the Preventive Engineering Committee; reports on the Foundation's medical research at The Saranac Laboratory by Dr. L. U. Gardner, and at the University of Pennsylvania by Dr. E. P. Pendergrass and Dr. Eliot R. Clark; and reports on legal developments affecting industrial hygiene during 1939, by T. C. Waters, of Baltimore.

USSR Studies Harnessing of Sun

MOSCOW—The problem of harnessing the sun's rays is being worked on in the Soviet Union, as well as in the United States. Experimental installations have already been produced and additional work has been approved by the Academy of Sciences of the USSR. The problem is of particular significance for the Central Asian republics, the Crimea and the Caucasus.

An experimental installation for producing refrigeration by solar energy has already been fitted up.

Heat Wave Strikes Los Angeles and A.C. Sales Jump

LOS ANGELES—The air conditioning industry in Los Angeles received its greatest impetus in more than a decade through an unprecedented heat wave which swept the city in mid-September in the course of which thermometer readings rose above 100F for a week.

The effect was expected, in fact, somewhat dumbfounding, to members of the air conditioning industry, who had anticipated a possible increase in turn-over because of the late season heat, but had not looked for the surprising demand for immediate and future-delivery installations.

The heat wave definitely made Los Angeles air conditioning conscious. It resulted in a reported sell out of available equipment by local air conditioning firms and representatives of eastern concerns for immediate installations in stores, cafes and cocktail bars. It served a further purpose in that it "made up the minds" of prospects who had not yet been completely sold on the idea of installing air conditioning systems. Contractors and unit representatives literally did a land office business during the hot spell.

Another basis for measuring the extent to which the people of Los Angeles were looking to air conditioning for relief from the heat was the number of telephone calls made to the Municipal Bureau of Power and Light for information on conditioning questions. Between September 16 and 24 (the duration of the excessive heat period) calls to the Bureau for air conditioning information were ten times the number in normal weeks in September.

Due to the attention centered on air conditioning, the Bureau is preparing to handle a substantial increase of activity in its refrigeration and air conditioning department. A continuing increase in electrically powered installations during the past two years made necessary the addition of 1845 hp. of air conditioning load to the Bureau's lines. In view of the number of new systems installed during the heat spell, plus the systems contracted for installation during the winter, the Bureau is preparing to make another substantial increase in its air conditioning load, according to W. W. Pearce, director of the department which handles air conditioning wirings for the Bureau.

Driscoll, Olvany Address Chapter

NEW YORK—The New York chapter of the ASHVE opened its 1939-40 season with talks by William H. Driscoll, former president of the ASHVE, and William J. Olvany, president of the Heating, Piping and Air Conditioning Contractors National Association.

Buffalo Winter Air Conditioning Market 5.3% Saturated, Utility Executive Tells Buffalo Council at Meeting

BUFFALO — The Air Conditioning Council of Western New York opened its 1939-40 season here Oct. 26 with an impressive dinner meeting in Hotel Lafayette attended by many of the city's outstanding bankers, industrialists, civic leaders and medical authorities as well as some 200 members of the council.

Speaker of the evening was Merrill E. Skinner, vice-president of the Buffalo, Niagara & Eastern Power Corporation, who traced the progress of air conditioning in Buffalo and prospects for its future development.

Among those at the speakers' table were Louis A. Harding, public works commissioner; Samuel B. Botsford, executive vice-president of the Buffalo Chamber of Commerce; Dr. Carlton E. Wertz, president of the Erie County Medical Society; J. L. Cooney, vice-president of the Cooney Refrigeration Company, Syracuse; Edward Cooney, president of the Cooney Refrigeration Company, Buffalo; David Diamond, corporation counsel, and Dr. Fraser Mooney, superintendent of Buffalo General Hospital.

Others introduced included Abe Stratton of Coleman-Stratton, Inc., treasurer of the council; Sherman Straus, chairman of the council's entertainment committee; Roswell Farnham, Buffalo Forge Company, past president of the council, and L. S. Saunders of the Harrison Radiator Company in Lockport, president of the Buffalo chapter, ASHVE.

Tracing the progress of air conditioning here, Mr. Skinner pointed out that as of Oct. 1 the local utility company had 157,643 resident electric customers. Of this number there were 4185 winter air conditioning installations representing a 2.67% saturation of the market.

"But half of these customers had central heating plants and by eliminating the stove customers we find that the saturation of the market actually is 5.3%," Mr. Skinner said. "This is better than we think," he added.

"In new homes, winter air conditioning has won a wide acceptance and almost all of these new structures are being equipped with winter air conditioning," he declared.

Discussing summer air conditioning, Mr. Skinner pointed out that up until this time this activity has been confined largely to the commercial field. The local utility company serves 22,300 of these commercial establishments of which 153 have installed summer air conditioning systems, the speaker declared.

"Thus it appears that we have just skimmed the cream of the potential air conditioning market in this area," he added.

Merrill E. Skinner

Mr. Skinner pointed out that there are 932 restaurants and food establishments in Buffalo of which 31 have some form of air conditioning; 93 retail jewelry stores of which four have air conditioning; 89 women's apparel stores of which four have installations; 32 department stores of which five have air conditioning, and 19 banks of which four are cooled.

Mr. Skinner went on to point out that the information furnished by the weather bureau is not always of great value to the air conditioning man. Weather bureau reports are fairly accurate for giving reports from various cities on a comparative basis, he said, but they do not clearly reflect temperature conditions as they prevail in the street or in buildings.

"Many people use the weather bureau report as a reason for saying 'no' to an air conditioning salesman," Mr. Skinner said. "The air conditioning man is interested not in the outside temperature but in the inside temperature." He then cited comparative figures showing the need for air conditioning here on many days of the year.

Mr. Skinner suggested that the City Council establish a weather station on Main St. so that wet bulb thermometers could measure the weather conditions experienced by the average working man and woman instead of the "dream world" on top of the New York Telephone Building where weather reports are now taken.

Pointing out that the Air Conditioning Council now is entering its third year, Mr. Skinner urged members to take more advantage of its many services and show a greater interest in its methods. "In three years this council has brought the merchandising of air conditioning out of a state of chaos into a sensibly run business," he said.

Mr. Skinner urged air conditioning men to accept the responsibility of seeing that the public gets what it pays for. He also declared that the council is contributing to the health and welfare of the community.

"By doing this you are building your business on a sound basis," the speaker said. "If you can find out how air conditioning will help the sick it will lead to a better program of helping those who are well," he concluded.

Walter P. Davis, secretary of the council, was in charge of arrangements for the meeting.

141 Utilities Report 770,525 Hp. of A.C. Installations Operating in Their Territories in March, 1939

NEW YORK.—According to a statistical report on "Air Conditioning Installations" just released by the air conditioning committee of Edison Electrical Institute*, there were 40,378 air conditioning installations on the lines of the 140 electrical utility companies reporting to the Institute, as of March 31, 1939. The capacity of these installations was 770,525 ⅜ hp. These installations were broken down as shown in Table 1.

Of the total, 1762 were in industrial building and the capacity of these was 89,922.35 hp., or 11.7% of the total. It is interesting to note that of the industrial installations, Rochester alone accounts for 30% of the installed horsepower, and that three cities—Philadelphia, Rochester and Chicago—account for slightly over 50% of the total installed horsepower in industrial buildings.

Although numerically not so great, the apartment house conditioning accounts for considerable capacity in New York, Washington, D. C., and Missouri as compared with other cities.

As will be noted in Table 1, the largest single classification of installations in capacity is theaters with 151,243.47 hp. The next largest group is industrial buildings, while the third is office buildings with 86,293.52 hp. This is followed by department stores with 76,405.25 hp.

The air conditioning committee which collected the statistics and prepared the report for Edison Electric Institute consisted of E. W. Gray, Oklahoma Gas & Electric Co.; E. W. Freund, Union Electric Co. of Missouri; E. M. Jergensen, Central Arizona Light & Power Co.; G. L. MacGregor, Dallas Power & Light Co.; A. D. Marston, Kansas City Power & Light Co.; H. H. Mather, Philadelphia Electric Co.; C. H. Randolph, Wisconsin Electric Co.; S. S. Sanford, The Detroit Edison Co., and R. H. Ten Eyck, Consolidated Edison Co., of New York, Inc.

The complete report is obtainable from the Edison Electric Institute, New York.

*Further information on this book appears on page 58.

TABLE 1.—TOTAL AIR CONDITIONING INSTALLATIONS REPORTED BY 141 ELECTRIC UTILITIES AS SERVED BY THEIR LINES AS OF MARCH 31, 1939

APPLICATION	NUMBER	HORSEPOWER
Residential:		
Apartments Private Homes	16,851	17,210.80
Commercial:		
Apartments	60	1,727.25
Banks	373	18,247.91
Barber and Beauty Shops	465	3,408.97
Broadcasting Studios	122	4,404.93
Clubs	207	4,401.29
Funeral Homes	509	5,159.05
Hospitals	314	4,611.34
Hotels	802	40,397.80
Office Buildings	657	86,293.52
Offices, Doctors and Dentists	644	1,690.05
Offices, Miscellaneous	5,462	44,695.67
Public Buildings	308	47,781.33
Recreational	153	2,860.30
Restaurants	3,253	61,879.27
Stores, Department	660	76,405.24
Stores, Drug	621	9,185.19
Stores, Retail Misc.	3,630	64,692.91
Theatres	1,648	151,243.47
Other Commercial	1,246	24,632.74
Industrial:		
Candy Manufacturing	157	9,413.67
Drug and Chemical Mfg.	49	2,329.30
Printing and Lithographing	92	5,846.46
Textile Manufacturing	38	1,839.25
Tobacco Manufacturing	27	1,495.43
Metal Working	3	16.00
Food Processing	78	2,782.35
Fur Storage	86	525.01
Other Industrial	1,232	65,674.88
TOTAL INSTALLATIONS	40,378	770,525.38
Installations included above that use power other than central station electric	21	4,773.00
Self-contained conditioners included above	8,652	18,226.71

ASME Members to Discuss Fuels at Philadelphia Meeting

PHILADELPHIA—Dedicated to "broadening the usefulness of the mechanical-engineering profession," the 60th annual meeting of The American Society of Mechanical Engineers will be held here at The Bellevue-Stratford Hotel, Dec. 4-8.

Over 100 papers will be presented at 34 simultaneous sessions scheduled during the week of the meeting. The chairman of the technical events committee, J. J. McCarthy, reports that those who cannot get away from their business during the daytime can attend one of the five simultaneous technical sessions, covering the topics of work standardization, motion economy in machine-shop practice, aeronautics, elasticity, and domestic fuels, which are planned for Monday evening, Dec. 4. Other subjects to be discussed are fuels, photo-elasticity, scientific analysis of managerial problems, industrial marketing, education and training, heat transfer, and thermodynamics.

Among the papers of interest to heating and ventilating men are the following:

DECEMBER 4
8 p.m.
AERONAUTICS SESSION

Heating and Ventilating of the Modern Airplane, by Herbert Kunen, Anemostat Corp.

Mechanical Aspects of the North Beach Airport, by S. E. Stott, deputy director, North Beach Airport, Flushing, N. Y.

DECEMBER 4
8 p.m.
SYMPOSIUM ON DOMESTIC FUELS

Domestic-Heating Boilers for Automatic Firing, by L. N. Hunter, National Radiator Co.

Anthracite as a Fuel for Domestic Heating, by Allen J. Johnson, Anthracite Industries Laboratories.

Domestic Bituminous Stokers, by H. E. Winkler, U. S. Machine Corp.

Domestic Oil Burners, by M. A. Powers, Timken-Silent Auto Div., Timken-Detroit Axle Co.

Domestic Heating with Coke, by Charles C. Russell, Koppers Co.

Gas Heating, by C. G. Segeler, American Gas Association.

DECEMBER 6
9:30 p.m.
HEAT TRANSFER SESSION

Laminar Flow Heat Transfer, by R. H. Norris and D. D. Streid, General Electric Co.

The Calculation of Heat Transfer in Cross-Flow Exchangers, by E. A. Schumann, Detroit Edison Co.

Heat Transfer to Falling Water Films, by W. H. McAdams, M. I. T.; T. B. Drew, E. I. DuPont de Nemours, and G. S. Bays, Humble Oil and Refining Co.

Mean Temperature Difference in Design, by W. Nagle and A. C. Mueller, E. I. DuPont de Nemours, and R. A. Bowman, Westinghouse Elec. & Mfg. Co.

Forum Discussion on Testing of Heat Transfer Equipment, led by H. C. Hottel, M. I. T.

DECEMBER 7
9:30 a.m.
PIPING SYMPOSIUM

The Significance of, and Suggested Limits for, the Stresses in Pipe Lines Due to the Combined Effect of Pressure and Expansion, introduced by D. B. Rossheim and A. R. C. Markl, M. W. Kellogg Co.

Air Conditioning for City Schools Proposed by Dr. Young

NEW YORK—Declaring that the future of our children depends on their health and education, and the future of our country depends on our children, Dr. Albert G. Young has proposed that elementary schools be provided with air conditioning. This was suggested before a meeting of the International Association of Electrical Leagues here October 4, on the basis of scientific investigations into the effects of air conditioning on the health of human beings, now being conducted at the completely air conditioned Corey Hill Hospital in Brookline, Massachusetts, of which Dr. Young is the medical director.

The speaker cited "controlled air" experiments with normal male subjects, lightly clothed, which showed that increasing the temperature and relative humidity of the air to severe summer conditions — 98F and 100% relative humidity—caused the subjects' body temperature, pulse, and respiration to increase to abnormal proportions. At the same time, the subjects exhibited mental and physical symptoms of a patient suffering from a febrile condition; they felt weak and drowsy, preferred not to converse, and could carry out simple mental calculations only with great effort.

Industrial Building Increases in N.Y.

ALBANY, N. Y.—For the second consecutive month the number of industrial building plans submitted to the State Department of Labor for approval reached a record high for corresponding months during the 16 years that plans have been submitted to the Department. The 128 plans submitted last month are the highest number for any September, exceeding the previous high of September 1937 by ten. The number of plans for September 1939 exceed the average for the previous 15 years by 66%. They represent contemplated investments of $1,522,765, which is $92,134 more than the average figure for September. The current report shows 11 more plans than in September a year ago and $273,765 more than the investments represented a year ago.

Oregon Chapter Given Charter

PORTLAND, ORE.—Heating and ventilating engineers of this city and state now have an organization of their own —a local chapter of the ASHVE. With due ceremonies, a charter was handed over to the newly formed Oregon chapter by the ASHVE October 5.

Assisting at the banquet and meeting held in the Marine Room of the Multnomah Hotel were engineers from Oregon, and some from Seattle, Wash. The new Oregon chapter, however, is the 28th chapter of the Society.

Safe Practice Meeting Held in Penn.

PHILADELPHIA. — The Pennsylvania Department of Labor and Industry sponsored a Safe Practice Conference at the Bellevue Stratford Hotel here October 11. The program follows:

100% Employee Co-operation in Eye Protection for the Fabricated Steel Industry, Albert T. Metcalf, safety engineer, Bethlehem Steel Company; Non-Toxicity of Cement Dust, R. B. Fortuin, director of industrial relations, Penn Dixie Cement Company; Simplification of the Attack on Silicosis, E. H. Dickenson, director rock drill service, Ingersoll-Rand Company; A Quantitative Test for Minute Traces of Lead, Dr. Frederick Smith, cancer research dept., Jefferson Medical Hospital, Philadelphia; Safe Practice in the Manufacture of Thermoplastic Acrylic Resins, Dr. D. S. Frederick, Röhm & Haas Company, Philadelphia; Profitable Recovery of Carbon Disulfide and Hydrogen Sulfide in the Viscose Rayon Industry, E. L. Luaces, chemical consultant, Woodhaven, New York; Safe Practice in the Control of Free Silica Glaze in Ornamental Tile Manufacture, R. E. Anderson, factory manager, Robertson Tile Works, and A Practical Discussion of Ventilation Testing Instruments, Dr. A. E. Brandt, research dept., Willson Products Corp., Reading.

Philadelphia Gas Rates Reduced

PHILADELPHIA—The Philadelphia Gas Commission has announced a reduction in rates for heating service to be effective December 1. About 4000 consumers will be affected with an estimated saving of more than $100,000 per year. It is hoped that there will shortly be a reduction in rates for general domestic gas service also.

The reduction applies on gas used after the first 5000 cu. ft. per month. There is no change in the present rate of 90 cents for the first 2000 cu. ft., and 85 cents for the next 3000 cu. ft. of use, but the next 15,000 cu. ft. rate is reduced from 75 cents to 50 cents, with excess use the same as at present. The annual minimum charge is to be reduced from $100 to $75.

With the reduced rates the company hopes to compete with oil and coal for the home heating market.

Armour Tech and Lewis Will Merge

CHICAGO—Armour Institute of Technology and Lewis Institute have entered into an agreement to consolidate into a great new technological center for Chicago. This is the first occasion on which two colleges of engineering have ever agreed to merge their interests to produce an institution of more important scope.

The name of the new school is to be Illinois Institute of Technology.

Housing Census Starts in April; Will be Valuable Source of Data

WASHINGTON—Plans for taking the first nation-wide census on housing in 1940 are well under way. The results of the survey should be of immense value to the entire building industry in that it will provide a wealth of information to guide the construction of better homes at lower cost, asserts Nathan Straus, Administrator of the United States Housing Authority, which urged legislation for the census.

The survey, which will start next April and will embrace every state, will be made in conjunction with the 1940 census of population.

Among the fundamental facts which it is expected the survey will bring to light are the following: Total number of dwellings; types and style of structures; essential household facilities; age, condition and state of repair; amount of overcrowding and doubling-up of families; monetary values of homes occupied by owners; rentals charged for leased dwellings; present mortgage status of dwelling properties, and costs of home financing.

Hailing the housing census as a most important and much needed contribution to the better housing movement in this country, Mr. Straus urged cooperation in it by the public generally and particularly by all organized groups interested in housing.

Night Clubs Forced to Ventilate

PORTLAND, ORE.—Ventilation systems and the sealing of windows to keep in noise, is the solution to loud or noisy night clubs and taverns, it was found here. Complaints of noise making in night clubs and cafes here recently resulted in an anti-noise committee being formed by hotelmen. Hotels in the downtown district found that noisy nightclubs were driving away hotel guests to quieter localities.

One of the night clubs, in order to retain its license, told the commission that hotel trade would not be driven away in future inasmuch as the ventilating system of the night club was being changed. With the installation of air conditioning, it is now possible to seal the windows and keep the noise in.

Construction Costs are Increasing

NEW YORK.—The Construction Cost Index of The American Appraisal Company shows a 1 point increase for September over August and a 2 point increase over July, 1939.

The index for September is 184 as compared with 181 for September a year ago, based on 100 for the year 1913.

The index for some western and southern cities shows 2 and 3 point increases as a result of their closeness to the lumber mills.

Dust Separating Apparatus Code Is Proposed by Engineers; Committee Appointed to Make First Draft

NEW YORK—With the increase in the rate of combustion in modern stoker-fired steam-generating units and the wide adoption of the pulverized-fuel method of firing, the necessity for removing the solid particles from the flue gas has increased. No standard or generally recognized method seemed to be available for determining the adequacy of dust-separating apparatus when installed in the power plant. Accordingly, after a discussion of this problem, the power test codes committee of The American Society of Mechanical Engineers decided to appoint a new committee to be known as individual committee 21, whose duty would be to draft a test code for dust-separating apparatus.

It is believed that in its present form this code meets the needs of all groups, manufacturers, public utilities, governmental agencies, etc., which from time to time have a part in the making of acceptance tests of this type of apparatus. However, the committee has decided to supplement its general distribution of tentative drafts of the code by a public hearing. This hearing has been scheduled for Monday, December 4, at 4:30 p.m. in the Bellevue-Stratford Hotel, Philadelphia, headquarters for the 60th annual meeting of the ASME. Complete copies of the proposed standard test code may be obtained from the Society's headquarters. All are invited to attend this hearing whether or not they hold membership in the Society.

From any person, who for one reason or another cannot attend the hearing, Committee No. 21, the main committee, and the Society will welcome suggestions for corrections or additions to this tentative draft. These communications should be addressed to the chairman of the committee, in care of The American Society of Mechanical Engineers, 29 West 39th Street, New York.

The term "dust-separating apparatus" is intended to include all devices used for separating gas-borne solid particles from the medium in which they are carried. This code is designed to cover tests on all types of dust-separating apparatus installed for operation in conjunction with solid-fuel-fired furnaces. It may be applied to a much wider field, but is not applicable to devices used in cleaning air for ventilation. Some of the names that have been applied to dust separators are as follows: Collector, catcher, trap, filter, precipitator, eliminator, washer, scrubber, and cyclone.

The individual committee which developed the tentative code consists of M. D. Engle, chairman, Boston Edison Company, Boston; Ollison Craig, secretary, Riley Stoker Corp.; E. L. Anderson, American Blower Corporation; A. D. Bailey, Commonwealth Edison Company, Chicago; H. H. Bubar, consulting engineer, New York; W. G. Christy, Dept. of Smoke Regulation, Hudson County, Jersey City, N. J.; H. O. Croft, State University of Iowa; J. M. DallaValle, U. S. Public Health Service; H. C. Dohrmann, Buell Engineering Company, Inc.; Philip Drinker, School of Public Health, Harvard University; J. Wm. Fehnel, Metropolitan Life Insurance Company; H. F. Hagen, B. F. Sturtevant Company; P. H. Hardie, Brooklyn Edison Company, Inc.; C. W. Hedberg, Research Corporation; J. H. Leech, Dracco Corporation, New York; H. E. Macomber, The Detroit Edison Company; H. B. Meller, Air Hygiene Foundation, Mellon Institute of Industrial Research; H. C. Murphy, American Air Filter Company; and B. F. Tillson, consultant, Upper Montclair, N. J.

NIAA Charter to California Group

LOS ANGELES—On October 19 the National Industrial Advertisers Association presented a charter to its nineteenth chapter, The Industrial Marketers of Southern California.

This new group, with headquarters in Los Angeles, held its first organization meeting more than a year ago. First president was Richard O'Mara of Western Precipitation Corporation, who successfully led the rapidly growing organization through the initial stages of progress. At the September meeting, the following officers were elected to steer I.M.S.C.'s course through the first year of N.I.A.A. affiliation: president, Martin R. Klitten, The McCarty Company; vice-president, Sam Eastman, Dozier-Graham-Eastman Co.; secretary-treasurer, K. L. Tate, Baker Oil Tools, Inc.; directors, Richard O'Mara, Western Precipitation Corp., and Don Mack, Weber Showcase & Fixture Co.; associate director, Hal G. Davis, George Rice & Sons.

Insulation Is Subject of Meeting

BOSTON.—The first of a series of five interesting meetings of the Boston Section, A.S.R.E., was held October 26 at Massachusetts Institute of Technology. John F. White, research engineer of the Monsanto Chemical Company, gave an illustrated talk on silica-aerogel insulation. Professor G. B. Wilkes of Technology, authority on insulating materials, conducted a discussion on the methods used to test this insulation.

Operating Men Discuss Problems in Cleveland Organization

CLEVELAND—Operating men here have what is believed to be the first organized discussion group holding luncheon meetings. The group is now in its second season after having enjoyed a highly successful series of programs last year. Known as the Cleveland Maintenance Group the organization is closely related to the Cleveland Association of Building Owners and Managers and has for its principal object keeping maintenance and operating men posted on new developments in their work.

Chairman is A. V. McFerron, of the Central National Bank, vice-chairman is J. E. Tomko of the Rose Building while Alvin P. Fortney of the Fidelity Building serves as secretary.

General plan of the meetings is the presentation of papers on subjects of interest by qualified Cleveland speakers, although round table discussions have been included from time to time. It is thought that similar groups may be organized in other cities throughout the country and that these groups may be tied together into a national organization.

A.C. Hits Open Air Movies in South

BIRMINGHAM, ALA.—The open-air picture show, commonly called the airdrome, has faded from the picture in this territory and air conditioning is responsible. The airdrome made capital of the fact that patrons could remain out in the open air where it was cool, but the air conditioned houses now have that appeal and more, for they have climatic comfort in summer and winter to offer.

Pulverized Fuel for Soap Plant

CLEVELAND — The H. K. Ferguson Company, of Cleveland and New York, has been awarded contract for the rebuilding of the boiler plant, and installation of a 200,000-pound B & W integral furnace steam generator, at the Ivorydale, Ohio, plant of The Procter & Gamble Company. This will be the largest integral furnace boiler for pulverized coal that has been built to date.

Beman Addresses Buffalo Chapter

BUFFALO—Myron C. Beman, of Beman & Candee, consulting engineers, discussed "Buffalo's New Civic Buildings" at the first meeting of the current season of the Western New York chapter of the ASHVE in the University Club, October 9.

Mr. Beman discussed air conditioning features of the city's new convention hall, the new Kleinhans music hall and other new civic projects.

Anthracite Consumption Off 11%, Bureau of Mines Reports for 1938

PITTSBURGH—Pressure from competitive fuels and a year of abnormally high temperatures combined to lessen the 1938 demand for anthracite, according to the U. S. Bureau of Mines in its annual report on anthracite. Total production fell from 51,856,000 net tons in 1937 to 46,099,000 in 1938, or 11%, thus receding to a point below the depression years of 1932 and 1933. This compares with a drop of 23% in the production of bituminous coal.

Prices at the mine for both domestic and steam sizes were slightly higher in 1938 than in 1937, and wholesale prices for coal on tracks at destination were about the same. Shippers to the larger markets, especially New York, were afflicted by price cutting among the producing interests on so-called distress coal, despite attempts at stabilization.

As anthracite is essentially a household fuel the weather has an important bearing on the demand. Mild weather in the spring of 1938 and again in the late fall adversely affected the anthracite market.

The principal markets for Pennsylvania anthracite are the New England States, New York, New Jersey, Delaware, Maryland, Pennsylvania, and the District of Columbia, which took 84.2% of the production of anthracite in 1936 and 80.2% in 1937. Of the mineral fuels available for use in these States (excluding the important item of bituminous coal, for which no data are available, and natural and liquefied gases), the share contributed by anthracite continued to decline, as did the total apparent consumption of all fuels.

Consumption of anthracite, briquets, coal, and fuel oils (in terms of coal) was equivalent to 71,706,000 tons in 1936 and declined 3.4% to 69,293,000 tons in 1937. Comparable data for 1938 are not yet available. Of the total fuels in 1936 and 1937, respectively, Pennsylvania anthracite comprised 64.1 and 60%; imported anthracite, 0.9 and 0.6%; briquets, 0.2 and 0.1%; coke for domestic use, 7.0 and 5.8%; imported coke, 0.3 and 0.2%; and heating and range oils, 27.5 and 33.3%.

In 1937 the coal equivalent of heating and range oils available for use was more than half the tonnage of anthracite. The losses in anthracite consumption were balanced by gains in the use of heating and range oils, which increased 17% over 1936.

Sales of coke for domestic heating, fuel briquets and packaged fuel, manufactured gas for domestic use and for house heating, and natural gas for all purposes for the most part either declined or increased only moderately in 1938.

Heating Contractors Face Exam

LOS ANGELES—Heating and ventilating contractors are among the subcontractor groups which, by a new ruling of the California Contractors' State Licensee Board, effective October 1, are obliged to submit to a qualification examination before being issued licenses to operate in the state.

The ruling applies only to original applicants and provides that, in addition to the filing of an application blank and the payment of the required $10 fee, the applicant take and obtain a passing grade of 70% in an examination testing his general knowledge of the building, safety, health and lien laws of the State, and of rudimentary administrative principles of the contracting business.

When the application has been filled out and passed by an employee of the Licensee Board, the applicant is given a set of examination questions which he must, in the presence of the examiner, answer in writing in the time allotted. The answers are graded immediately and the examinee informed whether or not he has achieved a passing grade. In case of failure to pass, he may, under the ruling, take another examination after a full day has elapsed and upon the payment of an additional $10 examination fee. No limit has been set in the number of examinations an applicant may take. If re-examinations are taken within six months from the filing of the original application, no new application blank need be filled out.

The examination consists of twenty questions to be answered as "true" or "false."

Each applicant must include in his application the signatures of at least seven references to his character and integrity: Two from civil or structural engineers, architects or contractors; two from persons for whom the applicant has performed a considerable amount of work, such as contractors, superintendents or foremen; two from building supply firms; and one from a banking institution.

Phila. Schools Offer A. C. Courses

PHILADELPHIA—The Spring Garden Institute has started its course on Heating and Air Conditioning with 17 students. Other schools offering similar courses are Temple University, Drexel Institute of Technology, and the Jourden Technical School.

Temple offers a two-year course, the first year covering Heating, and the second year covering Ventilation and Air Conditioning. Twenty-nine are registered for the Heating course, and 15 for the Ventilating-Air Conditioning course. There is also a course on Refrigeration, with 18 registered.

R.R. Conditioning Subject of Meeting of Boston A.C. Bureau

BOSTON—Members of the Air Conditioning Bureau and friends held their regular monthly meeting Oct. 10, at the University Club. Guest speakers were Maurice K. Dugan, trustees' representative on the New Haven railroad management, and Dr. C. P. Yaglou of the Harvard School of Public Health. Mr. Dugan's address was on "What Air Conditioning Has Done for the Railroad," while Dr. Yaglou spoke on the "Effect of Temperatures on Bacteria Count in Railroad Cars."

Mr. Dugan, digressing from his subject briefly, explained the subject of public relations of railroads and other public utilities and then showed its connection with air conditioning of railroad cars, saying that air conditioning has more to do with increased railroad travel than anything else, such as streamlining, greater speeds, decorated cars and softer cushions. The Pennsylvania Railroad, for example, has shown a 38% increase in through passenger traffic since the advent of the streamlined trains with their air conditioning.

Dr. Yaglou, speaking from the scientist's standpoint on air conditioning of railroad cars, showed that the average car has approximately 5000 cubic feet, or 60 cubic feet per passenger, compared with 250 to 300 cubic feet per pupil in a school, or 500 to 1000 cubic feet in an average bedroom. Owing to mechanical and other limitations, the supply of fresh air in a railroad car is necessarily restricted, and air conditioning must be with re-circulated air.

The larger amount of bacteria colonies in railroad cars is due largely to this re-circulation, as air washers are only twenty to fifty per cent efficient in the average car, especially if the filters are not changed frequently. Germicides added in the air washer streams, however, can raise the efficiency to as high as eighty per cent.

Odors require 10 to 20 c.f.m. to clear by dilution with outside fresh air. He told of various tests in de-odorizing with and without the use of ozone. A concentration of .015 was required in supplying 22 c.f.m. per person, with children as the experimental subjects.

N.Y. Reports '39 A.C. Installations

NEW YORK — According to reports from the Consolidated Edison Company of New York, Inc., air conditioned installations connected to the lines of that utility in Manhattan for the first nine months of 1939 totaled 271 jobs, with a capacity of 9444 hp. Similar figures for Brooklyn are 59 jobs totaling 563 hp.; for Queens, 76 jobs totaling 1840 hp.; and for the Bronx, 24 jobs totaling 486 hp.

WITH THE MANUFACTURERS

Gas Appliance Group Elects Adams

NEW YORK.—"There are impounded today in America vast resources of capital, use of which can be had by American industry provided in return for that use industry shall accept its fair responsibility in the promotion of the general welfare of the country," E. R. Guyer, of Chicago, retiring president of the Association of Gas Appliance and Equipment Manufacturers, declared when he opened the organization's fourth annual meeting at the Hotel Roosevelt in New York City, October 9.

Mr. Guyer said that the problem before industry today "is the responsibility of tapping those vast resources of capital." He stated that the gas industry had tried to accept its share of that responsibility by promoting for the American people the greater use of, at the most economical cost for, gas as a national fuel.

Frank H. Adams, vice-president and general manager of the Surface Combustion Corp., Toledo, was elected president of the AGAEM for 1939-40. Mr. Adams is a director of AGA, past president of the Toledo Rotary, and a trustee of the Toledo Chamber of Commerce.

A. P. Brill, president, Ruud Manufacturing Co., was elected vice-president. John A. Fry, president, Detroit-Michigan Stove Co., was elected treasurer.

RMA Re-Elects Shipley President

NEW YORK—The Refrigerating Machinery Association, in its annual meeting at the Hotel Lexington recently, continued to stress the need for equipment standardization in the refrigerating machinery industry. Several proposed new standards were carefully reviewed, particularly those affecting the performance of vertical single-acting ammonia compressors.

W. S. Shipley, president of York Ice Machinery Corporation, was reelected president of the Association, and J. I. Lyle, president of Carrier Corporation, was reelected vice-president. The following were elected to the executive committee for the year: D. Norris Benedict, vice-president and general manager, Frick Co., Inc.; H. A. Feldbush, general manager, Carbondale Division, Worthington Pump and Machinery Corp.; J. M. Fernald, general manager, Baker Ice Machine Company, Inc.; G. A. Heuser, president, Henry Vogt Machine Co.; and Emil Vilter, chairman of the board, The Vilter Manufacturing Co.

William B. Henderson was reappointed executive vice-president.

Oil Burner Institute Meets in N.Y., Adds Delco to Its Members

NEW YORK—The board of directors of Oil Burner Institute held a regular quarterly meeting October 10 and elected Delco Appliance Division, General Motors Sales Corporation, to manufacturer membership.

A program committee on 1940 activities was appointed, consisting of W. A. Matheson, chairman, Ray G. Whipple and Herbert Gillis. This committee has power to appoint sub-committees on special phases and will report to the board at the January meeting in Cleveland, January 25.

Copies of "Where Do We Go From Here?", a brochure just published by the Institute, were distributed at the meeting and will be circularized to the industry. This publication discusses the prominent part played by the Institute in the industry's development and devotes several pages to the problems that must be met and solved by the industry.

An important decision made was a method of sales reporting whereby manufacturers would file with C. F. Curtin a standard confidential monthly report giving the number of conversion, boiler-burner and furnace-burner unit sales for the previous month. The report will include only actual sales billed during the month of these units. Mr. Curtin will compile the figures and send them in totals to the reporting manufacturers. The following companies will report initially, and it is hoped that fully 85% of the production will be enrolled in a few months: Gar Wood, General Electric, ABC, Bethlehem Foundry, Lynn, Malleable Iron Fittings, Silent Glow, Williams Oil-O-Matic, Herco, Delco, Reif, Quiet May, Electrol, Petro, and Harvey-Whipple.

The executive committee was empowered to pass on membership applications received for the remainder of the Institute year. Dues of these new members will be pro-rated on a monthly basis. President Dewey reported the Manufacturer Membership was the largest in several years and said that unity of thought and action was being accomplished.

An emergency legislative committee, with Earl Marr as chairman, was appointed.

Convector Sales Up in August

WASHINGTON.—Sales of complete nonferrous convector radiators amounted to 786,563 sq. ft. as compared with 657,196 sq. ft. in July, according to the Department of Commerce. Sales of cast iron convectors increased from 810,703 sq. ft. in July to 1,105,658 sq. ft. in August.

Koppers Will Study Stoker Coal

PITTSBURGH—A permanent program of investigation and research work in connection with the stoker coals produced by The Koppers Coal Company has been begun. Walter Knox, formerly with the stoker division of Fairbanks, Morse and Company, Armour Institute and the Whiting Corporation, has been employed to carry on this work in a special laboratory at Koppers' Seaboard plant. The project will be supervised by J. D. Doherty and will be an activity of the research and development division.

Some of the subjects studied will include: Determination of practical ways of eliminating common difficulties, adapting new coals for stoker use, investigations of various types of treatment, determining factors influencing coke formation, means of controlling coking tendencies, determining fusion ranges suitable for domestic underfeed stokers, investigating effect of different feed and air settings upon individual coals, study of overdraft needs of different coals, and means of eliminating fly-ash.

Goodman Completes Lecture Tour

LA CROSSE, WIS.—William Goodman, member of The Trane Company Development Committee, has just returned from an extended lecture tour of important Western cities. Mr. Goodman addressed the chapters of the ASHVE in Portland, San Francisco, Los Angeles, and Dallas on dehumidification of air with coils.

Additional talks were delivered at the annual convention of the Pacific Coast Gas Association in San Francisco, where Mr. Goodman discussed air conditioning fundamentals illustrated on the psychrometric chart, and before the engineers of the Puget Sound Navy Yard at Seattle.

To Study Hot Water Unit Heaters

NEW YORK—For the past three years the Industrial Unit Heater Association has been systematizing and publishing its established standards and working data. Encouraged by the favorable response of architects, engineers and the buyers of unit heaters the Association at its Chicago meeting, October 6, approved further extension of this work.

It is intended that the engineering committee shall develop recognized practices for the application of unit heaters supplied with hot water. Further study is also to be undertaken on corrosion in steam heating systems in cooperation with other interested groups.

NEW EQUIPMENT

Very high heat transfer.

Tilco-Fin Heat Transfer Tubing

NAME AND MODEL NUMBER—Tilco-Fin extended surface tubing No. 581½.

PURPOSE—For providing a high rate of heat transfer between heating or cooling medium and air.

FEATURES—Both the tubing and the fins are of copper. The bond is obtained partially by tension and partially by the sprayed metallic bonding to which all exterior surfaces are subjected. Tube has an inside diameter of 23/40 inch and an over-all diameter of 1½ inches. Manufacturer claims a heat transfer of 22,800 B.t.u. per hr. per sq. ft. with air flow 600 f.p.m., 75° entering air and 5 lb. of steam on two banks of staggered tubes. The resistance to air flow is said to be .045 of an inch of water per sq. ft. face area.

MADE BY—*Tilco-Fin, Inc., Brooklyn, N. Y.* *1*

Fischer-Smith Heating Control

NAME—Fischer-Smith electronic heating control.

PURPOSE—For the control of steam or hot water heating systems.

FEATURES—Control consists of an outdoor element, a radiator element, a control panel, and the necessary motor operated valves or switches for controlling the heat. The outdoor element measures the demand for heat, as it is affected by the temperature, wind and other outside conditions, while the radiator element measures the heat input to the building. Whenever the demand is greater than the input, the control box calls for more heat and whenever the demand is less than the input, the control box calls for less heat. The control elements are simply resistance wires which change their resistance with the temperature. A modified bridge circuit measures the resistance of each element and whenever they differ a relay is operated to turn the heat on or off. Radio tubes are employed to amplify the current so that it can operate the relay. The manufacturer claims the following outstanding features: Extreme sensitivity; only one moving part—the relay; low voltage control wiring; applicable to any radiator heating system to provide modulating, impulse or cycling control; responds to wind; inexpensive. Controls are furnished with adjusting knobs to adapt the control to a particular building and to give rapid heating up periods. They also may be obtained with a program clock to give a night cycle, heating up cycle and normal cycle.

MADE BY—*Fischer-Smith, Inc., West Englewood, N. J.* *2*

Extreme sensitivity and low cost.

Westinghouse 100-Ton A.C. Compressor

NAME — Westinghouse hermetically sealed 100-ton compressor.

PURPOSE—For air conditioning installations requiring cooling unit of high capacity.

FEATURES — This 90° V-type compressor is stated to require but 1/3 the space and to be 2/3 as heavy as conventional compressors for the same capacity. Compressor has 16 cylinders, is hermetically sealed and is direct driven by a motor with a speed of 1150 r.p.m. Size is reduced by using cold refrigerant gas from the evaporator to cool the driving motor, thus making it possible to install the compressor in a space without regard for ventilation to carry away the heat losses of the motor. Maintenance expense is said to be reduced by the hermetically sealed design as there is no shaft seal. Direct drive motor and compressor are mounted on a common crankshaft and a reversible oil pump provides positive lubrication regardless of direction of rotation. Servicing is stated to be a simple operation since the entire operating mechanism can be exposed by removing the side plates from the crankcase. No pipes need to be disconnected nor is the unit disturbed in any way. Compressor weighs 4200 lb. and is 90 in. long, 32 in. wide and 36 in. high. Compressor is designed to use Freon F12 refrigerant.

1/3 the space and 2/3 the weight.

CAPACITIES—1,212,000 B.t.u. per hr. based on 37 lb. per sq. in. gage suction pressure, 65F suction gas, 75F water in and 95F water out.

MADE BY—*Westinghouse Electric & Mfg. Co., East Springfield, Mass.*.....*3*

Herman Nelson Unit Heaters

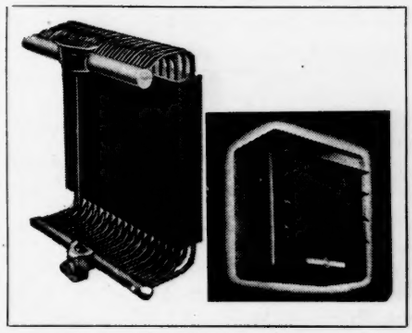
NAME — Propeller-Fan type hiJet heater.

PURPOSE—For supplying warm air using steam as the heating medium.

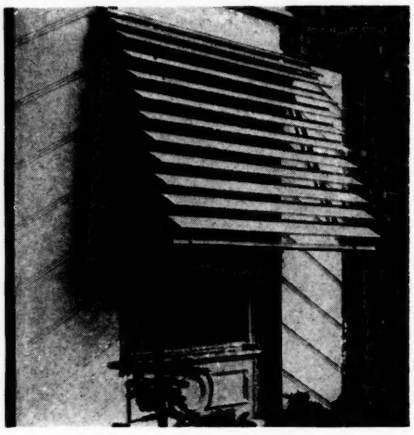
FEATURES—A patented "Stay Tube" has been built into the heating element between the supply and return headers to allow any entrained moisture which might otherwise be carried over into the heater to drain directly from the supply header to the return header without entering the other tubes of the heating element. If this entrained moisture is corrosive, as is sometimes the case, it will at first affect the "Stay Tube" which is made four times as heavy as the other tubes in the heating element, therefore, states the manufacturer, longer life is assured. Another function of the "Stay Tube" is to maintain the proper relationship between the supply and return headers and thus leave the loops free to take care of only the expansion and contraction between individual tubes.

SIZES AND CAPACITIES—18 sizes with capacities ranging from 15,450 B.t.u. per hr. to 350,000 B.t.u. per hr.

MADE BY — *Herman Nelson Corp., Moline, Ill.* *4*



"Stay Tube" gives longer life.



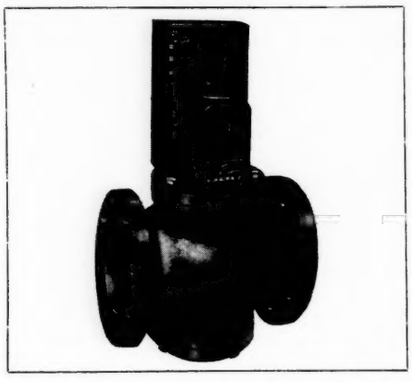
Less sun heat and better ventilation.

Russell Sheet Metal Awning

NAME—Rusco awning.
PURPOSE—For improving ventilation and reducing sun heat on non-air conditioned buildings and reducing the cooling load on air conditioned buildings.
FEATURES—This is a venetian type awning made entirely of sheet metal. Advantages are said to include year-round sun protection, full visibility, ventilation and light control, as well as the elimination of expense and inconvenience of installing, removing, storing, repairing and recovering. Shutters are made of galvanized Paintgrip sheets which are bonderized at the steel mill to take and hold paint.
MADE BY—*The F. C. Russell Co., Cleveland, Ohio.* 5

Au-Temp-Co Control Valves

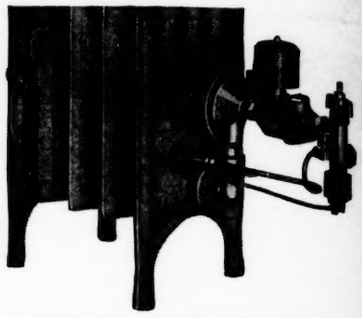
NAME—Au-Temp-Co improved motorized control valves.
PURPOSE—For two-position or modulating service in the control of steam, air, gases and liquids or for zone control of heating systems or for various ventilating and air conditioning applications.
FEATURES — Valves are offered in more than fifty types to meet a complete range of high and low applications and are available in two designs, (1) the motor mounted above the valve and (2) the motor mounted on the side of the valve. The manufacturer states that the compact assemblies permit installation in close quarters and that the moving parts are reduced to a minimum. The valves are motivated by an Au-Temp-Co Type ML reversing split-phase motor which operates in any position and in any direction. Made in either screwed or flanged type.
MADE BY—*Au-Temp-Co Corp., 1 Park Ave., New York.* 6



Controls the flow of steam, gases or liquids.

M-H Static Pressure Regulator

NAME AND MODEL NUMBER—Electric static pressure regulator, Type P212A.
PURPOSE—For controlling the static pressure in the discharge duct of a fan system, the overfire draft in a combustion chamber, or similar applications where definite static pressure conditions are to be maintained.
FEATURES — This regulator is designed for use in conjunction with a "Series 60 Floating" device such as a motorized damper. A simple means of adjustment is provided in order that the required settings may be easily made.
RANGE—Positive pressure 0 to ¾ in. water column (including differential) and negative pressure range 0 to 1 in. water column (including differential).
MADE BY — *Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.*....7



Safety pilot provides safe operation.

Automatic Gas Safety Pilot

NAME—Automatic control and safety pilot.
PURPOSE—For preventing a flow of gas to the burner in the absence of a pilot flame.
FEATURES—It is announced that this new automatic control and safety pilot is designed for use on the company's line of gas-steam radiators. The device uses a constant burning pilot and a positive safety pilot. In operation the valve is manually actuated with the reset button and the pilot flame is lighted. Within a few seconds the valve remains open. In the event of failure of the pilot flame the valve closes.
MADE BY—*Automatic Gas Steam Radiator Co., Pittsburgh, Pa.* 8

Louis Allis Adjustable Speed Motor

NAME—Adjusto-Spede.
PURPOSE—For driving equipment at variable speeds.
FEATURES—Motor is a combination of an eddy current clutch and a standard constant speed a.c. squirrel cage motor. There is no mechanical contact between the driving and driven members of the unit and the speed and torque variations are obtained by controlling the magnetic excitation of the clutch. The manufacturer states that the following functions can be performed by this unit without jar, shock or stress: Gradual or quick acceleration of the loads, rapid intermittent starting and disconnecting load, absorbs torsional impulses and vibrations, continuous operation at low speeds, and wide range of speed variations from zero to full speed at full load torque.
MADE BY—*The Louis Allis Co., Milwaukee, Wis.* 9

Eddy current clutch gives adjustable speeds.

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below circle the item number of the equipment in which you are interested, using the number found at the end of each item.

1 2 3 4 5 6 7 8 9

(This service available only to engineers or executives)

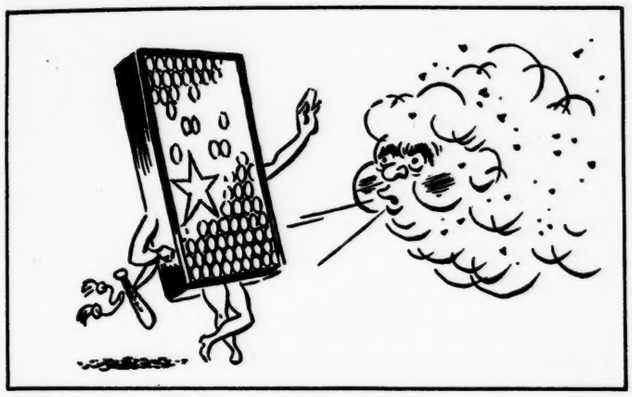
Fill in your name and address, detach and mail to HEATING & VENTILATING, 148 Lafayette St., New York, N. Y.

Name.....
Title.....
Firm.....
Business Address .....
City and State 11/39

How to get the most out of your filter installation

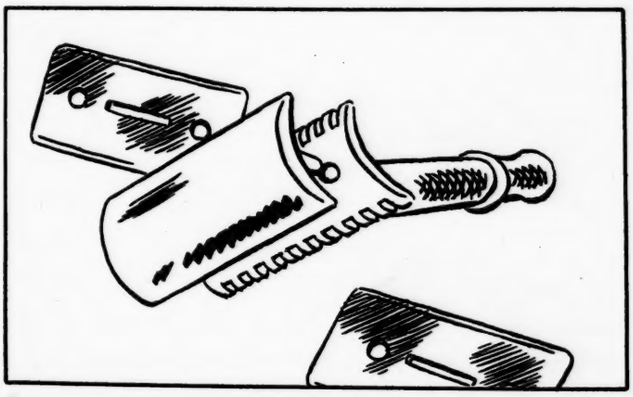
1 Watch the treasurer cut capers, when you order Dust-Stop Air Filters.* Why? Because they cost approximately 1 cent per CFM to install (including frames); and less than 1/10th of a cent per CFM to maintain. *Compare these costs with permanent and mechanical installations!*

2 Facts for the entire management! Dust-Stops are safer because the all-glass filtering medium, *Fiberglas**, and the *patented* adhesive will not support combustion.

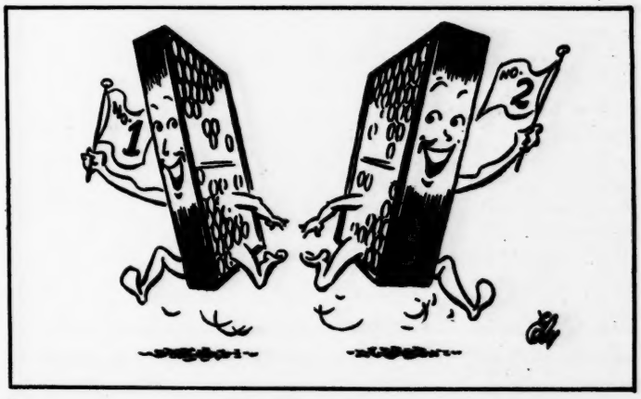


3 How about efficiency? Dust-Stops strain out virtually all "nuisance" dusts (including hay fever pollen). *Capacity*—2 CFM per square inch of area at 300 ft. FPM. *Resistance* (in water gauge per in. of depth)—.045 to .050 *clean* to .11 to .12 *dirty*.

4 You'll never have to take the blame for stained walls and ceilings, due to "bleeding" of your filtering adhesive, when you install Dust-Stops. Likewise, you'll never have to worry about the serious fire hazard of filtering oil blowing and settling in minute drops in the duct system.



5 Dust-Stops are as easy to change as a razor blade. Being a *"throw-away"* filter, Dust-Stops eliminate cleaning, recharging, draining, expert supervision, and the need to keep a supply of "spares". They fit all types of "L"—and "V" frame assemblies. *And are these facts good news!*



6 Dust-Stops are available everywhere. You can get them at a moment's notice. Order No. 1 Dust-Stops (1-inch) or No. 2 Dust-Stops (2-inch) from your air conditioning manufacturer, dealer or jobber of this equipment. Or write us direct: Owens-Corning Fiberglas Corporation, Toledo, Ohio.

FIBERGLAS DUSTOP AIR FILTERS

*T. M. REG. U. S. PAT. OFF.

Made by Owens-Corning Fiberglas Corporation, Toledo, Ohio

Degree-Day Figures for September, 1939

With this issue HEATING & VENTILATING begins its twelfth year of publishing degree-day data for various large cities

	Albany, N. Y.	Atlanta, Ga.	Baltimore, Md.	Birmingham, Ala.	Boston, Mass.	Buffalo, N. Y.	Burlington, Vt.
Degree-days for September, 1939.....	162	3	13	0	89	138	238
Degree-days for September, 1938.....	210	17	36	9	114	181	289
Degree-days for September, Normal...	72	0	0	0	48	75	144

	Cheyenne, Wyo.	Chicago, Ill.	Cincinnati, Ohio	Cleveland, Ohio	Columbus, Ohio	Denver, Colo.	Des Moines, Iowa
Degree-days for September, 1939.....	175	52	15	65	21	61	77
Degree-days for September, 1938.....	153	89	58	91	57	53	70
Degree-days for September, Normal...	240	3	0	27	0	72	0

	Detroit, Mich	Dodge City, Kan.	Duluth, Minn.	El Paso, Tex.	Erie, Pa.	Evansville, Ind.	Fort Wayne, Ind.
Degree-days for September, 1939.....	108	47	267	0	95	12	71
Degree-days for September, 1938.....	139	17	227	0	124	36	82
Degree-days for September, Normal...	42	0	261	0	36	0	0

	Fort Worth, Tex.	Grand Rapids, Mich.	Green Bay, Wis.	Harrisburg, Pa.	Hartford, Conn.	Indianapolis, Ind.	Ithaca, N. Y.
Degree-days for September, 1939.....	2	108	169	39	96	32	128
Degree-days for September, 1938.....	0	129	166	87	126	65	224
Degree-days for September, Normal...	0	57	132	0	48	0	96

	Kansas City, Mo.	Knoxville, Tenn.	La Crosse, Wis.	Lansing, Mich.	Lincoln, Neb.	Little Rock, Ark.	Los Angeles, Calif.
Degree-days for September, 1939.....	35	1	127	148	62	6	0
Degree-days for September, 1938.....	40	22	119	181	51	6	0
Degree-days for September, Normal...	0	0	96	114	0	0	0

	Louisville, Ky.	Madison, Wis.	Memphis, Tenn.	Milwaukee, Wis.	Minneapolis, Minn.	Nashville, Tenn.	New Haven, Conn.
Degree-days for September, 1939.....	8	108	8	94	149	7	76
Degree-days for September, 1938.....	39	129	12	113	119	24	114
Degree-days for September, Normal...	0	87	0	84	93	0	39

	New Orleans, La.	New York, N. Y.	Norfolk, Va.	Oklahoma City, Okla.	Omaha, Neb.	Peoria, Ill.	Philadelphia, Pa.
Degree-days for September, 1939.....	0	24	0	12	67	49	16
Degree-days for September, 1938.....	0	53	11	9	59	81	44
Degree-days for September, Normal...	0	0	0	0	0	3	0

	Pittsburgh, Pa.	Portland, Me.	Portland, Oreg.	Providence, R. I.	Reading, Pa.	Reno, Nev.	Richmond, Va.
Degree-days for September, 1939.....	30	170	59	84	43	—	3
Degree-days for September, 1938.....	66	195	19	109	89	49	31
Degree-days for September, Normal...	0	120	105	63	0	144	0

	Rochester, N. Y.	St. Louis, Mo.	Salt Lake City, Utah	San Francisco, Calif.	Scranton, Pa.	Seattle, Wash.	Spokane, Wash.
Degree-days for September, 1939.....	117	16	58	81	100	129	118
Degree-days for September, 1938.....	176	36	7	126	157	64	56
Degree-days for September, Normal...	72	0	18	114	60	192	192

	Springfield, Ill.	Syracuse, N. Y.	Toledo Ohio	Trenton, N. J.	Utica, N. Y.	Washington, D. C.	Wichita, Kan.
Degree-days for September, 1939.....	28	118	75	39	115	13	39
Degree-days for September, 1938.....	46	199	101	74	233	43	26
Degree-days for September, Normal...	0	96	9	0	182	0	0

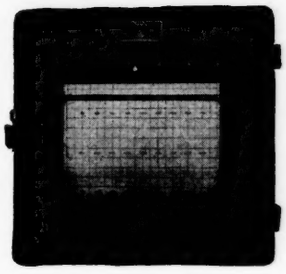
Methods of applying the degree-day in connection with the operation of heating plants or for the prediction of fuel consumption of heating plants are described fully in the new enlarged edition of the DEGREE-DAY HANDBOOK, published by HEATING & VENTILATING, 148 Lafayette Street, New York, price $3. Degree-days as given above for a "normal" month or season are based on averages for a long period of years, ending about 1922. Averages covering different periods will disagree with the above figures slightly.

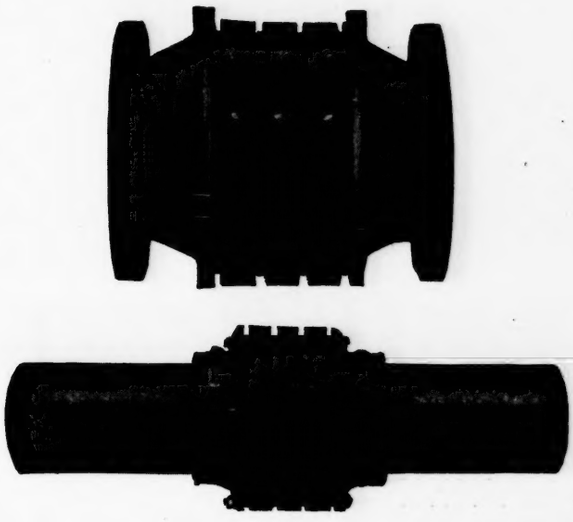
HEAT TREATMENT

with *Expansion Joints* made by

E. B. BADGER & SONS CO.

. . . and Your Purchasing Dollar





Ever hear of "metal fatigue"? Of course, you have and so have Badger engineers. They have spent many years studying fatigue of metals and ways of minimizing it. They are utilizing throughout the manufacture of BADGER Expansion Joints the most thorough and scientifically applied heat treatment possible. It is proper heat treatment throughout fabrication, not just a "lick and a promise."

When you are buying expansion joints, inquire thoroughly into the question of heat treatment. It's one of the plus values you get when your purchasing dollar goes into the Directed Flexing Expansion Joint made by . . .

Other BADGER Features

Directed Flexing Design

Wide Range of Traverse Capacities

Line of Stainless Steel as well as Copper Expansion Joints

No Packing Required

E. B. BADGER & SONS CO.

75 PITTS ST., BOSTON, MASS.

AGENTS IN PRINCIPAL CITIES

Summer Degree-Hours for September

THE number of variables which affect the summer air conditioning load is high, and the dry-bulb temperature of the outside air is of much less importance among the other variables than it is in connection with winter heating. It is doubtful if any one single factor can ever be used to show load proportionality for different types of buildings in the summer as it can in winter with the degree day.

However, where there is little internal load, either sensible or latent, such as in residences, some such simple proportionality may exist. Research at both University of Illinois and by Detroit Edison Company indicates that the load unit for residences for summer may be the summer degree-hour above 85F.

The figures below show the number of degree-hours of current interest for a number of cities.‡ To obtain them, 85 was subtracted from the hourly temperatures for each hour it was over 85F, and results totaled.

The first two columns of figures are the degree-hours totaled for September, 1939 and September, 1938. The third and fourth columns show the maximum and minimum number of degree-hours experienced during the Septembers in the eight-year period from 1932 to 1939.

The fifth and sixth columns show the cumulative totals for the summer (1939 and 1938) up to and including September 30. The last two columns show these cumulative seasonal totals *for the year having the highest and lowest cumulative total up to September 30.*

Nineteen of the 31 cities listed below had the hottest September (as indicated by degree-hours) this year of any over the 8-year-period covered by the records. These cities were scattered all the way from Boston to San Diego. On the west coast both San Diego and San Francisco broke previous September records badly. Houston, San Diego and San Francisco set new high seasonal totals. On the other hand only one city, Birmingham, set a new low figure for the season.

‡Maximum, minimum, and average seasonal totals of summer degree hours are included in both tabular and map form in the Air-Conditioning Engineers' Atlas, by Strock and Hotchkiss, The Industrial Press, 148 Lafayette St., New York. Price, $2.

SUMMER DEGREE-HOURS (ABOVE 85F)*
SEPTEMBER, 1939

City	Sept., 1939	Sept., 1938	Sept., Max.†	Sept., Min.†	Season, Total to September 30			
					1939	1938	Max.†	Min.†
Baltimore	120	45	187	8	1532	1378	2178	1080
Birmingham	380	303	723	57	1811	2296	3906	1811
Bismarck	78	109	135	16	1247	1033	4624	1033
Boston	77	0	77	0	316	354	734	204
Buffalo	7	0	7	0	36	17	113	11
Chicago	510	14	510	5	831	337	1797	337
Cincinnati	678	84	678	68	1167	704	3937	704
Cleveland	175	0	175	0	294	142	710	142
Columbus	625	56	625	22	1430	969	2797	854
Des Moines	834	359	834	9	2351	2455	6560	1502
Detroit	393	1	393	1	801	340	1879	340
Ft. Wayne	550	17	550	0	1002	353	2741	353
Grand Rapids	288	0	288	0	814	293	1901	293
Houston	937	497	937	122	4484	3078	4484	2895
Indianapolis	743	86	743	11	1466	671	4432	671
Kansas City	1559	599	1559	76	5177	4904	12399	2562
Memphis	942	441	942	90	2638	3002	4711	2057
Milwaukee	400	1	400	0	691	233	1090	233
Minneapolis	224	5	229	0	1040	540	3017	540
New Orleans	546	229	1012	207	2740	3037	3450	2067
New York	4	0	47	0	250	207	556	75
Philadelphia	57	0	140	0	770	580	1340	577
Pittsburgh	175	2	177	2	457	365	1262	293
Portland, Ore.	17	61	125	0	793	589	851	174
Richmond, Va.	192	52	332	24	1327	938	2453	938
St. Louis	1023	469	1023	30	2337	2952	8361	2285
San Diego	404	3	404	0	419	3	419	0
San Francisco	197	4	197	0	197	4	197	0
Savannah	782	362	864	133	3109	2963	3494	2260
Toledo	372	12	372	1	705	445	2064	445
Washington	120	26	204	3	1336	1192	1945	1192

*Computed from data made available through the cooperation of the U. S. Weather Bureau.
†See text for definition of this term.

TRADE FRICK MARK

Refrigeration
Air Conditioning

Using three big Frick Machines, totaling 650 tons capacity—a cooling effect equal to using 1,300,000 pounds of ice a day.

The air conditioning system, designed by Charles S. Leopold, includes radiant heating and cooling by pipes within the outside walls.

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DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

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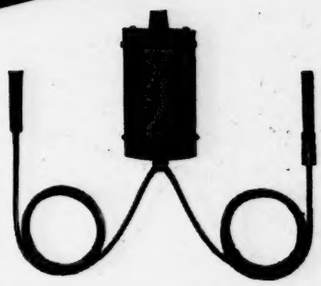
Weather-Controlled HOT WATER!



With the AU-TEMP-Co Type LD Differential Aquastat, hot water temperatures can now be maintained automatically—in line with outdoor weather changes! Twin precision-built thermal elements work hand in hand to give precise control. As weather conditions change, outdoor element activates element immersed in water to be controlled.

Available with control ranges and adjustments as required. When used with AU-TEMP-Co clocks, unit can be switched automatically from day to night operation. Dual Control type also available.

Top Values in CONTROL MOTORS

Years of field service have proved AU-TEMP-Co Type ML Reversing Control Motors rugged and efficient. Precision-built to control louvre damper, valve and similar operations. Split-phase units designed for two, three or five-position as well as proportioning and modulating service. Start, stop and operate in any position—in either direction. Available in wide range of shaft speeds and torques, and with manual positioning switches. Standard or special timings as ordered. Compact, tamperproof.

For operating dampers required to close on current failure, select AU-TEMP-Co Type MLY or MLZ Spring Return Motors with design features providing extremely powerful lift at damper shaft.

Write for latest bulletins and control data.

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AUTOMATIC CONTROLS AND SYSTEMS FOR EVERY HEATING, AIR CONDITIONING AND PROCESS CONTROL PURPOSE.

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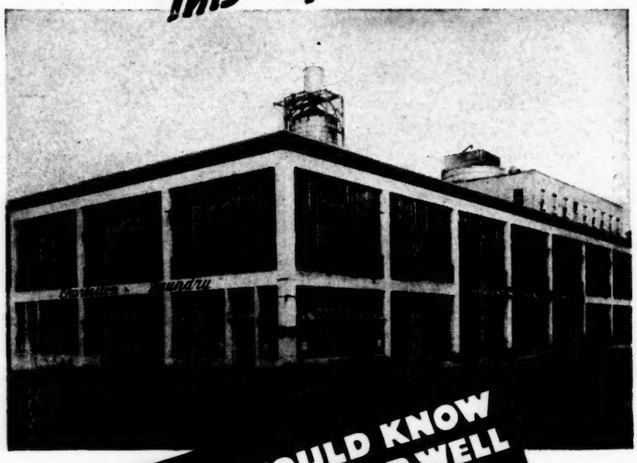

YOU, TOO, WOULD KNOW THAT STERLING DEEP WELL TURBINE PUMPS are

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- *LOWER IN MAINTENANCE COST,*
- *TROUBLE FREE!*

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If you want to make savings in handling water, or if you have water handling problems, we can help you as we have helped many others. Write today.

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•There are also Sterling Vertical Centrifugal Pumps, Sterling Sump Pumps, Sterling Propeller and Mixed Flow Pumps, and Sterling Jet Pumps . . . Precision Built, Yet Cost No More!

COMING EVENTS

NOVEMBER 14-15, 1939. Fourth annual meeting of Air Hygiene Foundation including forum on "Industrial Health Pays Double Dividends" and technical program to be held at Mellon Institute, Pittsburgh. For further information, address Dr. H. B. Meller, managing director of the Institute.

NOVEMBER 15-16, 1939. American Management Association production conference on Industrial Preparedness. Headquarters, The Palmer House, Chicago.

DECEMBER 4-8, 1939. 60th annual meeting of The American Society of Mechanical Engineers at The Bellevue-Stratford Hotel, Philadelphia. Includes, December 4, a symposium on domestic fuels and a heat transfer session on December 6. See News of the Month department for further information.

JANUARY 15-18, 1940. Sixth annual convention of the Refrigeration Service Engineers Society in conjunction with the Second All-Industry Refrigeration and Air Conditioning Exhibition sponsored by the Refrigeration Equipment Manufacturers Association, to be held in Chicago. National Secretary of the Society, H. T. McDermott, 433 N. Waller Ave., Chicago.

JANUARY 16-18, 1940. 35th Annual Meeting, American Society of Refrigerating Engineers, Hotel Blackstone, Chicago, Ill. ASRE headquarters, 37 West 39th St., New York.

JANUARY 22-24, 1940. Annual convention, National Warm Air Heating and Air Conditioning Association, Hotel Hollenden, Cleveland, Ohio. To be held in conjunction with the Sixth International Heating and Ventilating Exposition. NWAH & AC Assoc., Managing Director, 5 E. Long St., Columbus.

JANUARY 22-26, 1940. 46th annual meeting of the American Society of Heating and Ventilating Engineers, Hotel Statler, Cleveland, Ohio. To be held in conjunction with the Sixth International Heating and Ventilating Exposition. ASHVE, 51 Madison Ave., New York.

JANUARY 22-26, 1940. Sixth International Heating and Ventilating Exposition to be held at Lakeside Hall, Cleveland. Exposition under the direction of Charles F. Roth, International Exposition Co., Grand Central Palace, New York.

WITH THE MANUFACTURERS

Detroit Stoker Co., Detroit, has appointed *W. Harwell Allen* as representative in Western Tennessee, with headquarters at Nashville, P. O. Box 682. Mr. Allen's home address is 114 17th Avenue, North, Telephone 5-2328.

Kramer Trenton Company is the new name of the Trenton Auto Radiator Works, Trenton, N. J. *Nathan Kramer* is president of the new company, and *Israel Kramer* is secretary-treasurer.

Norge Heating and Conditioning Division of Borg-Warner Corp., has advanced *H. M. Campbell* to the position of sales manager. Mr. Campbell has been a member of the Norge sales organization for the past five years.

Sprayo-Flake Company, Chicago, has appointed *R. E. Bennett,* vice-president in charge of sales, with headquarters at the main office in Chicago. Mr. Bennett was formerly sales manager of the Thermax Department of Celotex Corporation.

Viking Air Conditioning Corp., Cleveland, has appointed *F. L. Duff* as production manager. Mr. Duff will also assist *Arthur Bennekamper,* plant manager.

NEW TRADE LITERATURE

Bearings. A standard size 8-page catalog No. 739 describing the Sealmaster ball bearing pillow blocks, flange units and take-up units. Gives information on the construction, dimensions and capacity of pillow blocks, flange units and take-up joints. STEPHENS-ADAMSON MFG. CO., AURORA, ILL. 10

Boilers. Three standard size publications dealing with Kewanee boilers. The first leaflet, RFL-1, is a single sheet and discusses the Kewanee small steel Round "R" boiler with insulating blanket in Smartline Jacket. This boiler is used for heating homes and small buildings and also for supplying domestic hot water. The second publication is a four-page catalog, C-92d, covers the smartline Round "R" boilers for hand-fired coal. The third is a four-page catalog, 96, and presents information on firebox boilers for high-pressure steam. These boilers are designed for pressures of 100 to 150 lb. with loads of 25 to 300 hp. each. Also presents information on the Type K boiler for loads as small as 4 hp. KEWANEE BOILER CORP., KEWANEE, ILL.....11

Convectors. A standard size, 24-page catalog, No. 4039, dealing with Young Streamaire convectors. Gives information on the complete line of Streamaire convectors together with data on sizes, capacities, types and styles available. Also gives installation information. YOUNG RADIATOR CO., RACINE, WIS. 12

Evaporators. A standard size, 18-page catalog, No. 5039, describing the complete line of Young evaporators for use in cooling and air conditioning equipment. Gives information on construction, operation, sizes and capacities. Also contains data on how coils should be selected, how to select expansion valves and sizing refrigerant lines. YOUNG RADIATOR CO., RACINE, WIS. 13

Registers. A standard size, eight-page catalog, No. 39, describing the Tuttle and Bailey line of new Adjustiblade registers. Gives information on the construction, sizes, capacities and cost. TUTTLE & BAILEY, INC., NEW BRITAIN, CONN. 14

Steam Traps. A standard size, 36-page catalog and educational handbook on condensate drainage. Out of a total of 36 pages, 18 are devoted to handbook material on the rates of condensation, heat transfer, pipe sizes, piping layouts, maintenance and like subjects. Equipment covered by specific recommendations includes unit heaters, jacketed kettles, syphon drained cylinders, water heaters, pipe coils, steam mains, and steam purifiers. Catalog also lists all the products in the Armstrong line and gives complete information on sizes, capacities and prices. ARMSTRONG MACHINE WORKS, THREE RIVERS, MICH. 15

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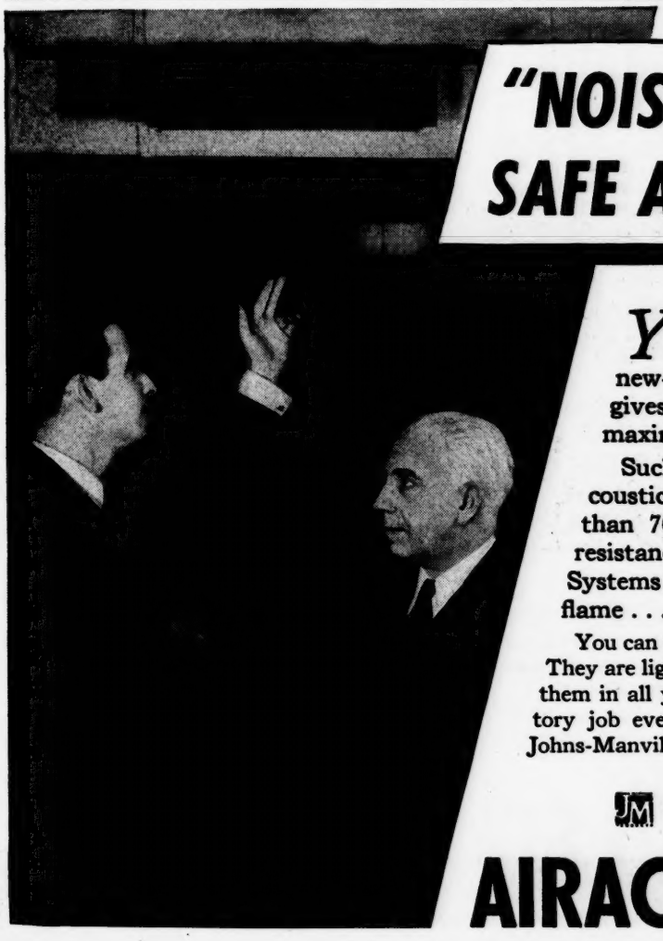

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